Introduction to Programming and Computing for Scientists

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Tutorial 2a: writing a document using LaTeX

You need a text editor and a LaTeX distribution

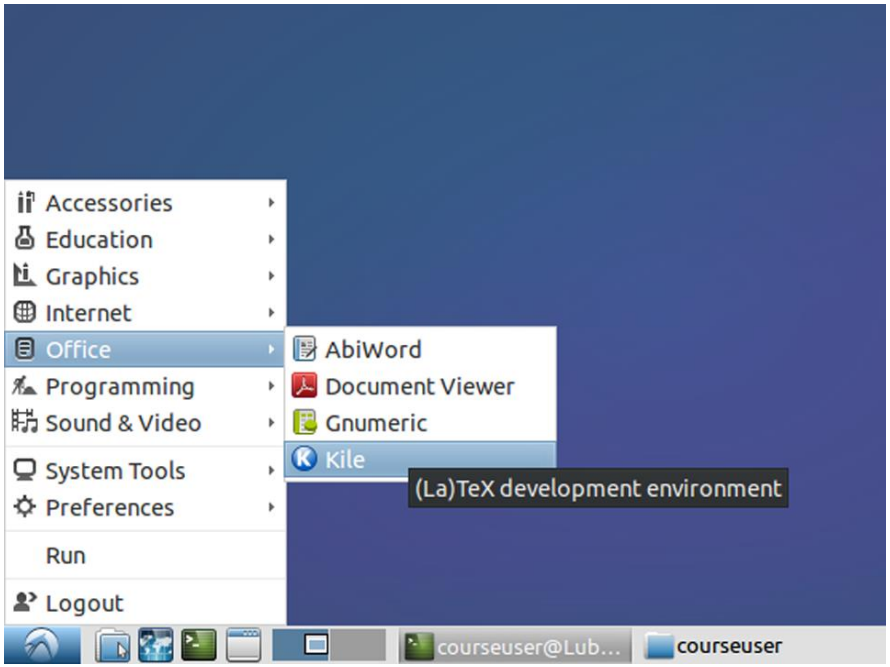
- LaTeX files are simple ASCII files, like any program code
- They can be edited on any platform (Linux, Windows, anything) using any text editor
- These days everybody prefers to have the result in PDF
  - This was not the case 20 years ago, so by default LaTeX produces DVI files
  - All modern LaTeX systems can build PDF as well (**`pdflatex`** command in Linux)
- There are different LaTeX distributions, all based on the same LaTeX2e version

Platform	LaTeX distribution
Ubuntu, Debian	**`texlive, texlive-base, texlive-full`**
RedHat, CentOS, Fedora, SuSE	**`texlive, texlive-base, texlive-latex`**
Linux	**`tetex`** *– not supported since 2006*
Windows	**`MiKTeX`**
Mac OS	**`MacTeX`**

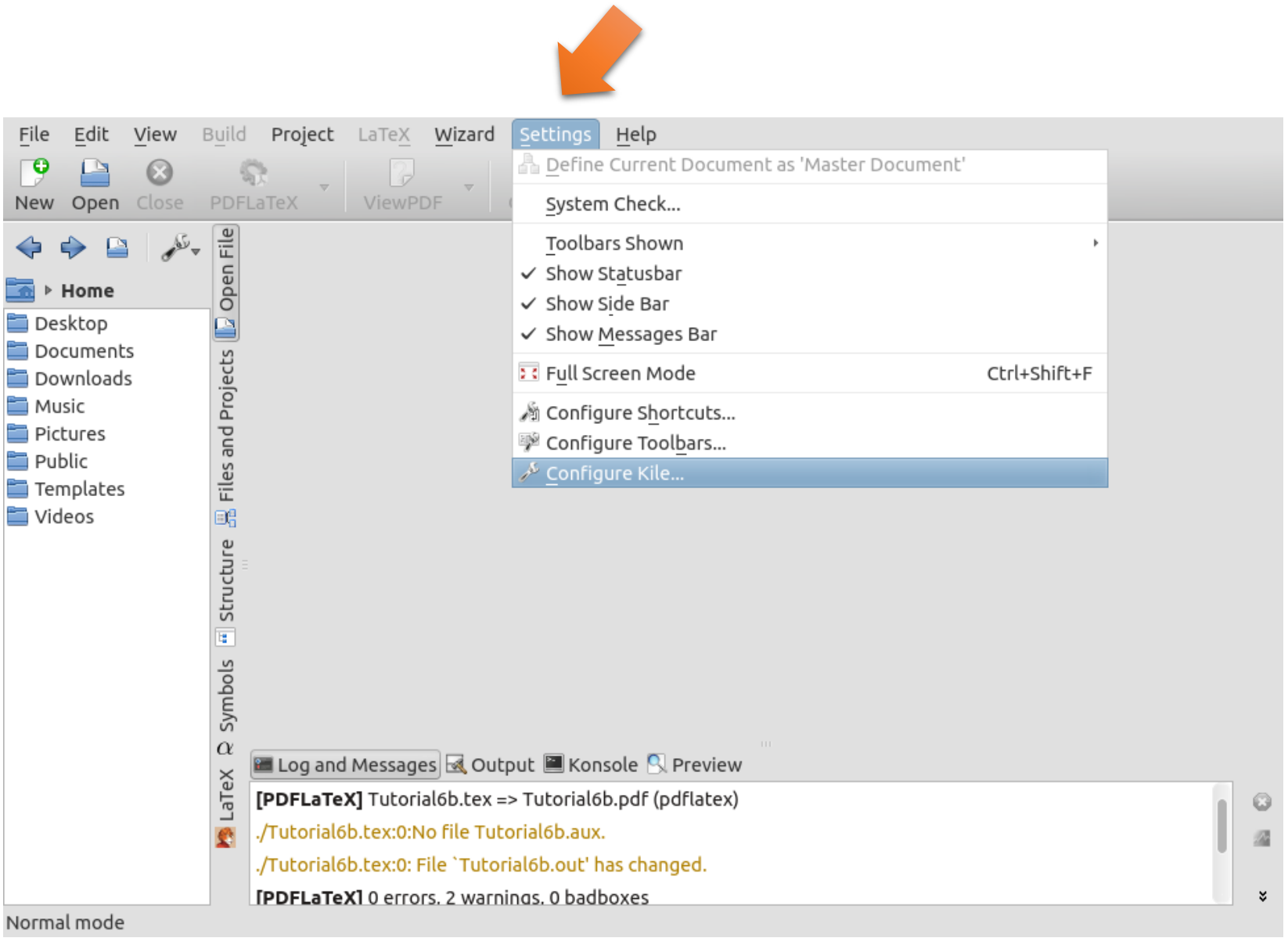
- There are many packages not included in the typical distributions, but they always can be added later

Highly recommended way: use a LaTeX IDE

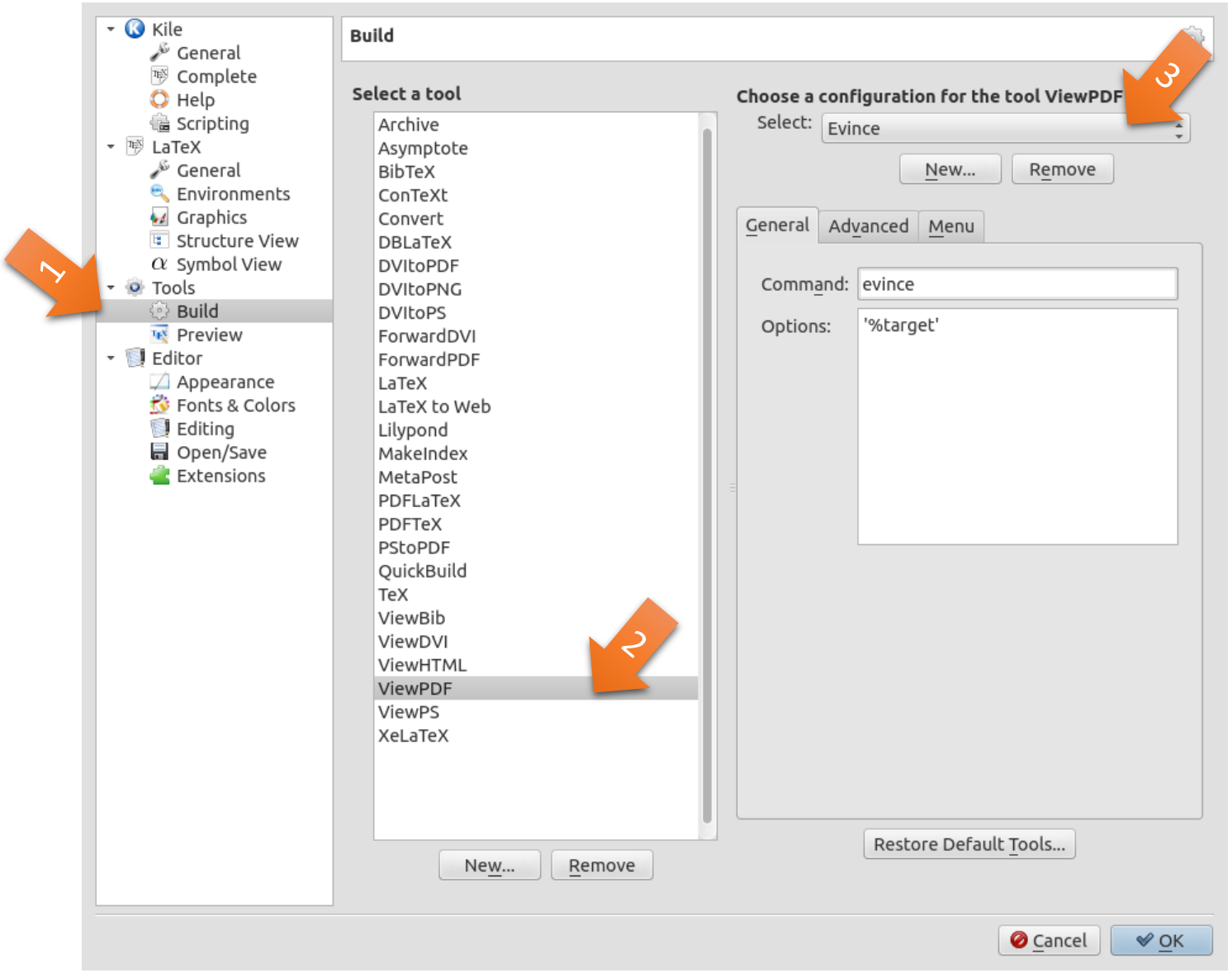
- LaTeX IDEs can:
  - Edit the text, highlighting elements and environments
  - Assist in typing the environments and tags
  - Offer menus for most common environments, tags, symbols etc
  - Offer single-click interface to build and view LaTeX files
- Many such IDEs exist, today we will use **`Kile`**
  - Find it in the menu, or type **`kile`** in "Run"



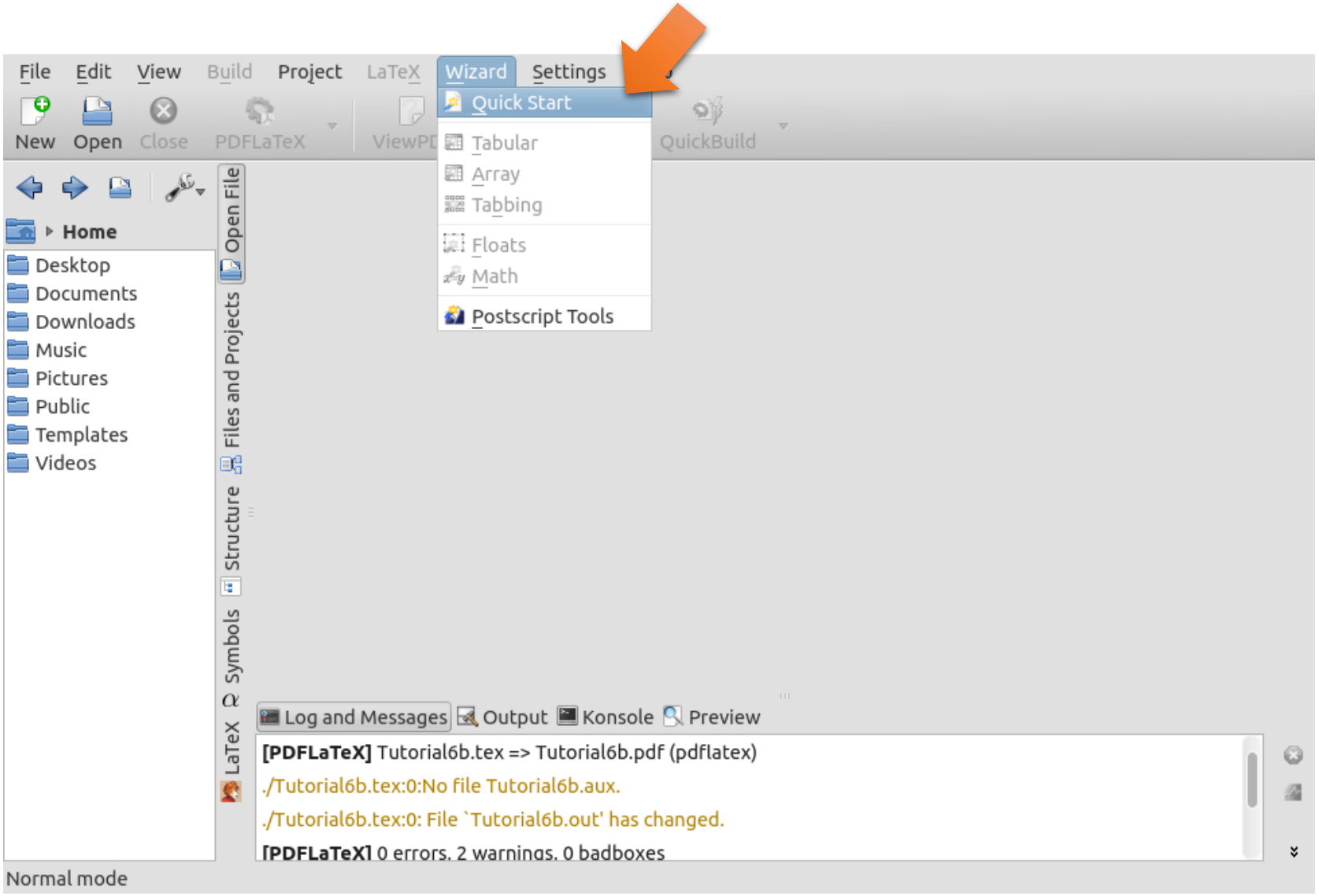
Configure your Kile



Configure your Kile: select Evince as PDF viewer

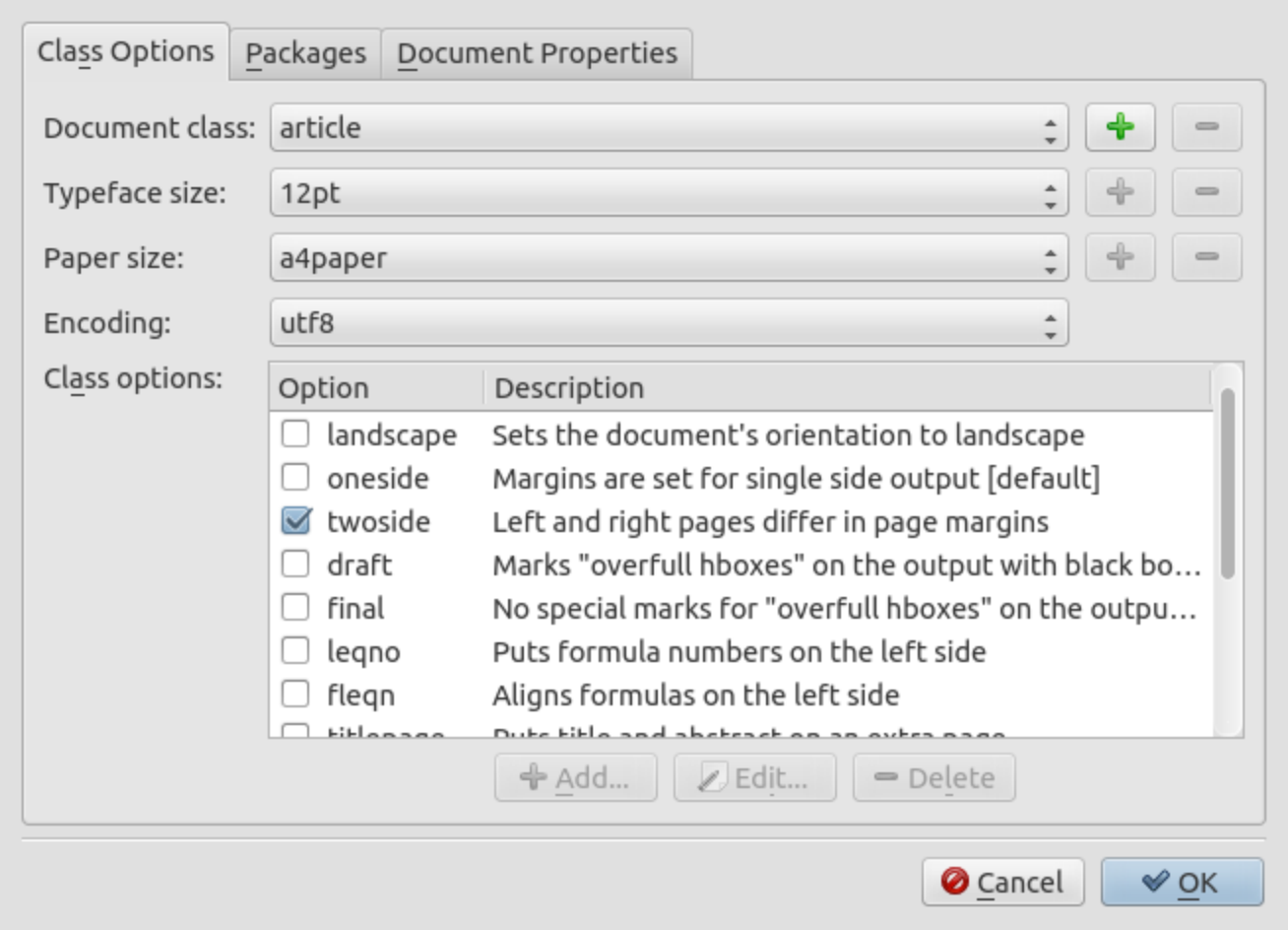


Quick-start the new document using Kile Wizard



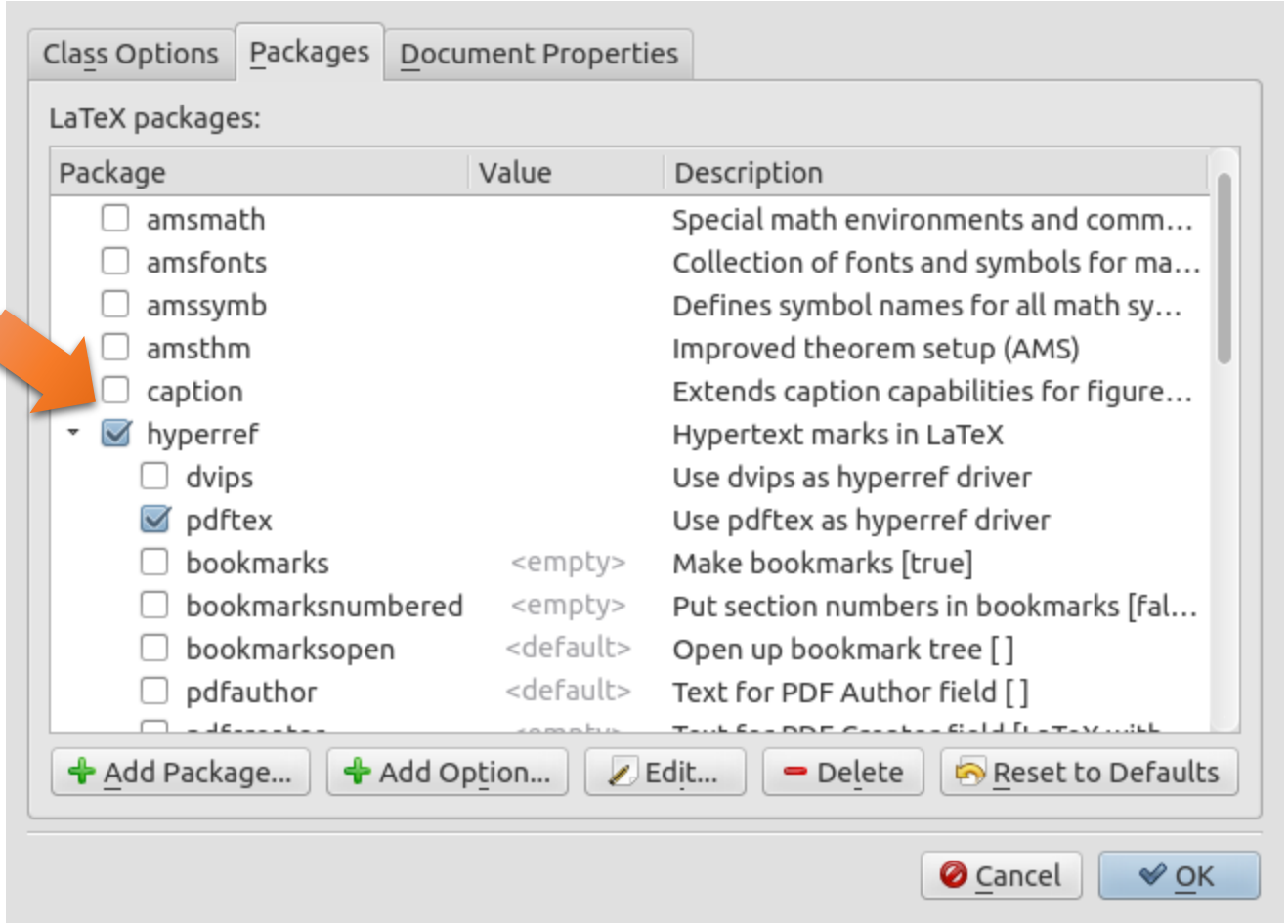
We will make an article for a two-sided A4 printing

Don’t click OK yet, let’s go to the Packages tab



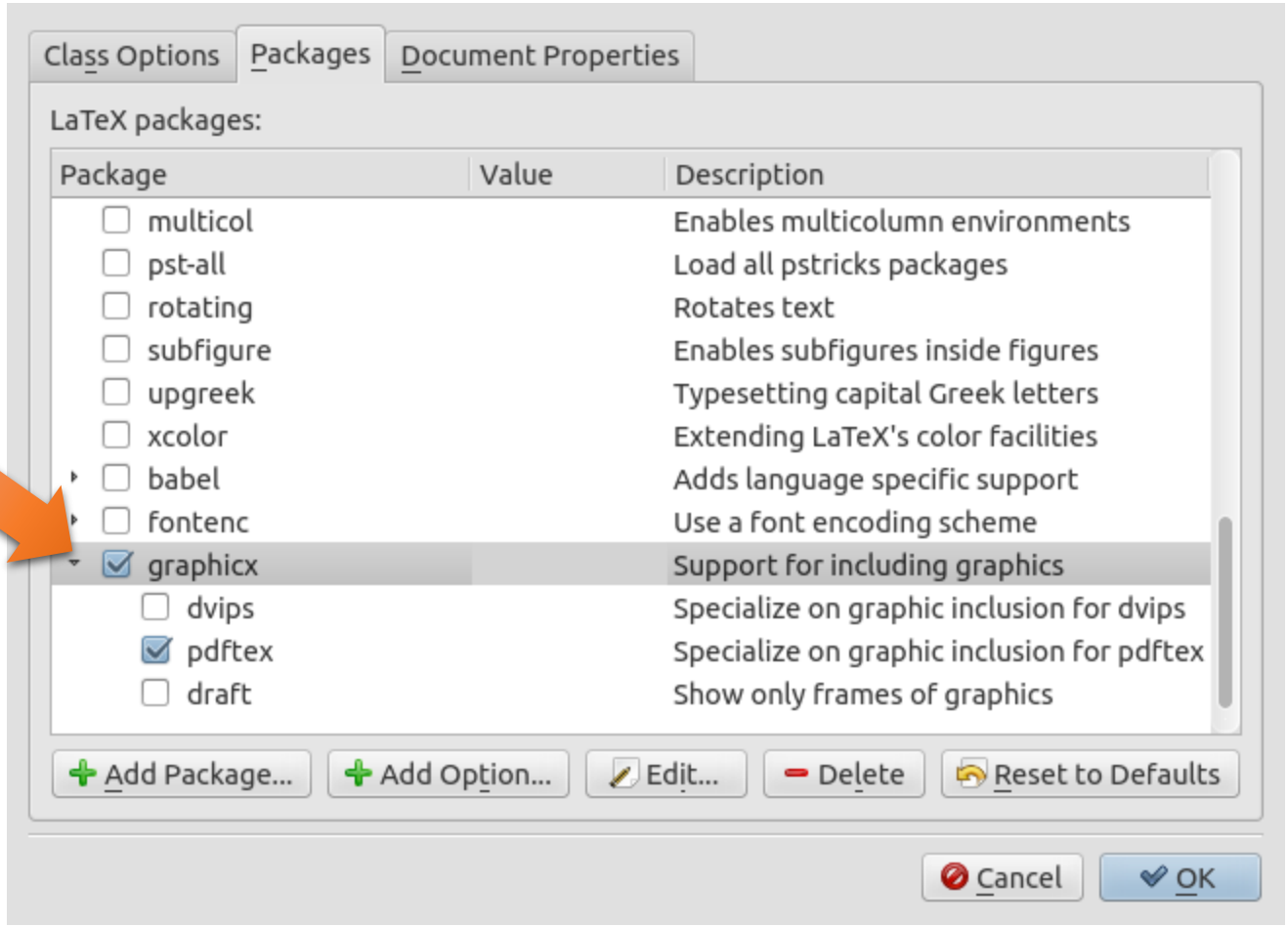
Let's pick some useful LaTeX packages

`hyperref` with **`pdftex`** will make PDF files with clickable cross-references

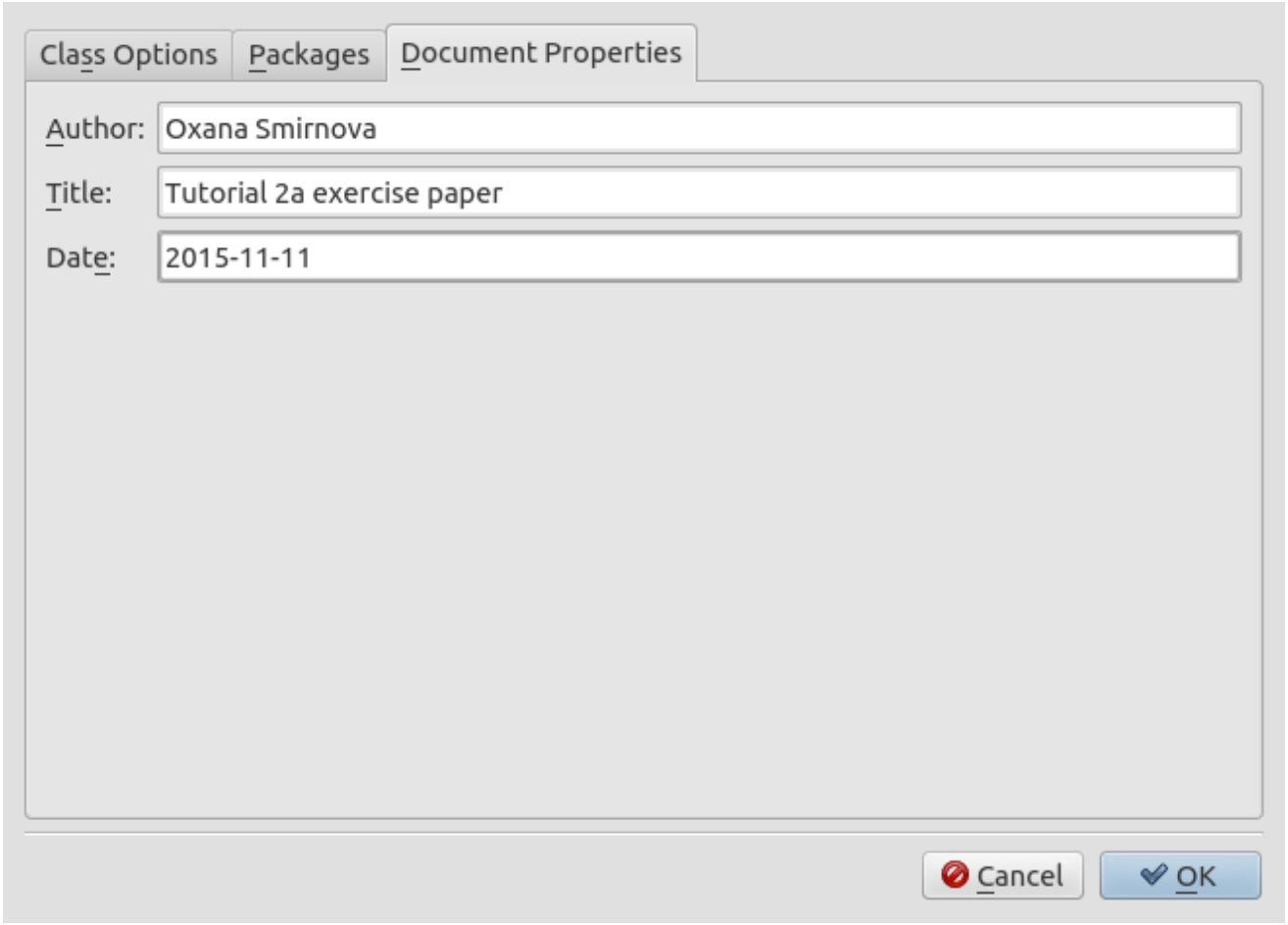


More useful packages

`graphicx` with **`pdftex`** will allow to insert raster graphics (JPG, PNG etc)

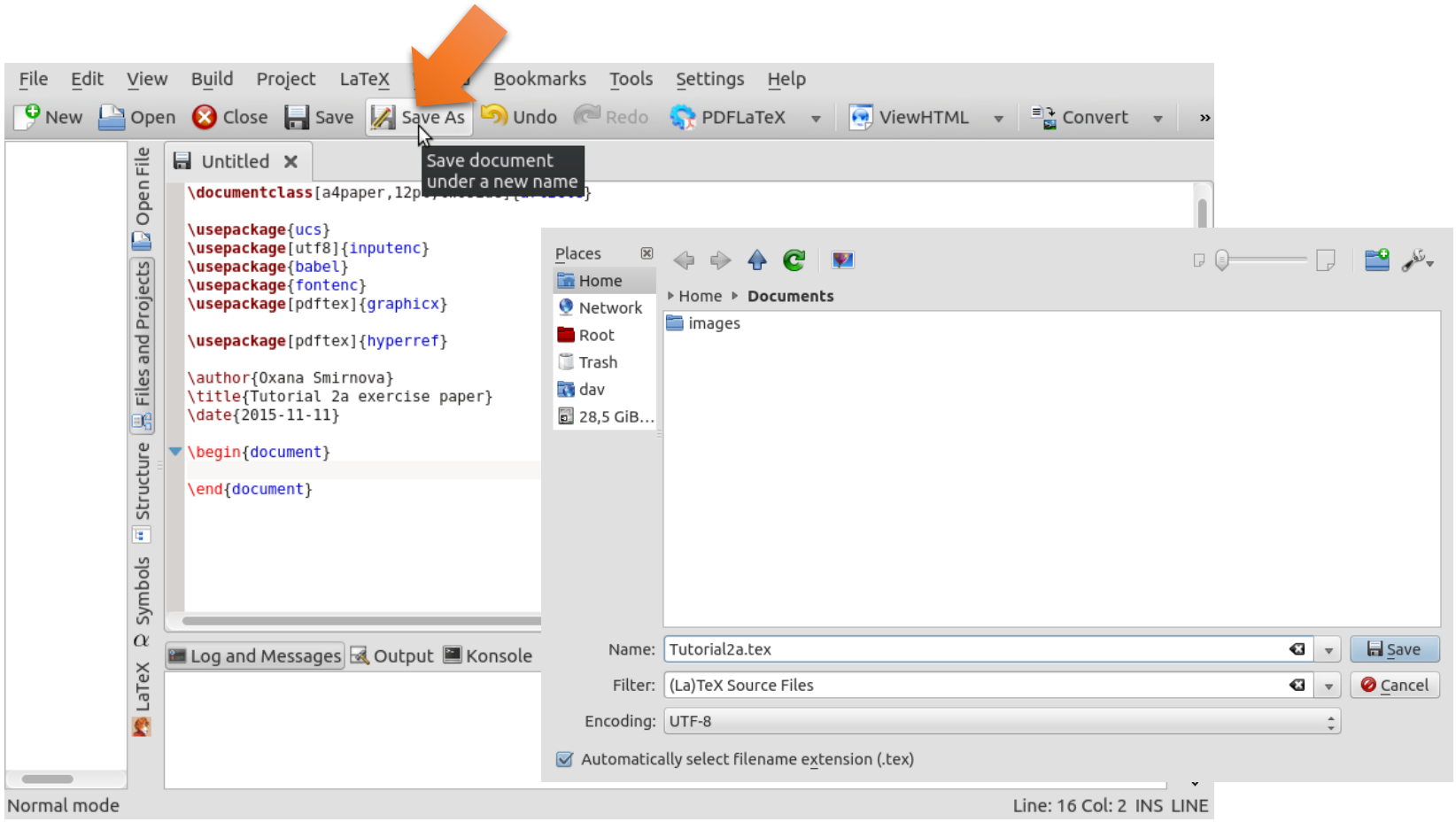


And now some metadata

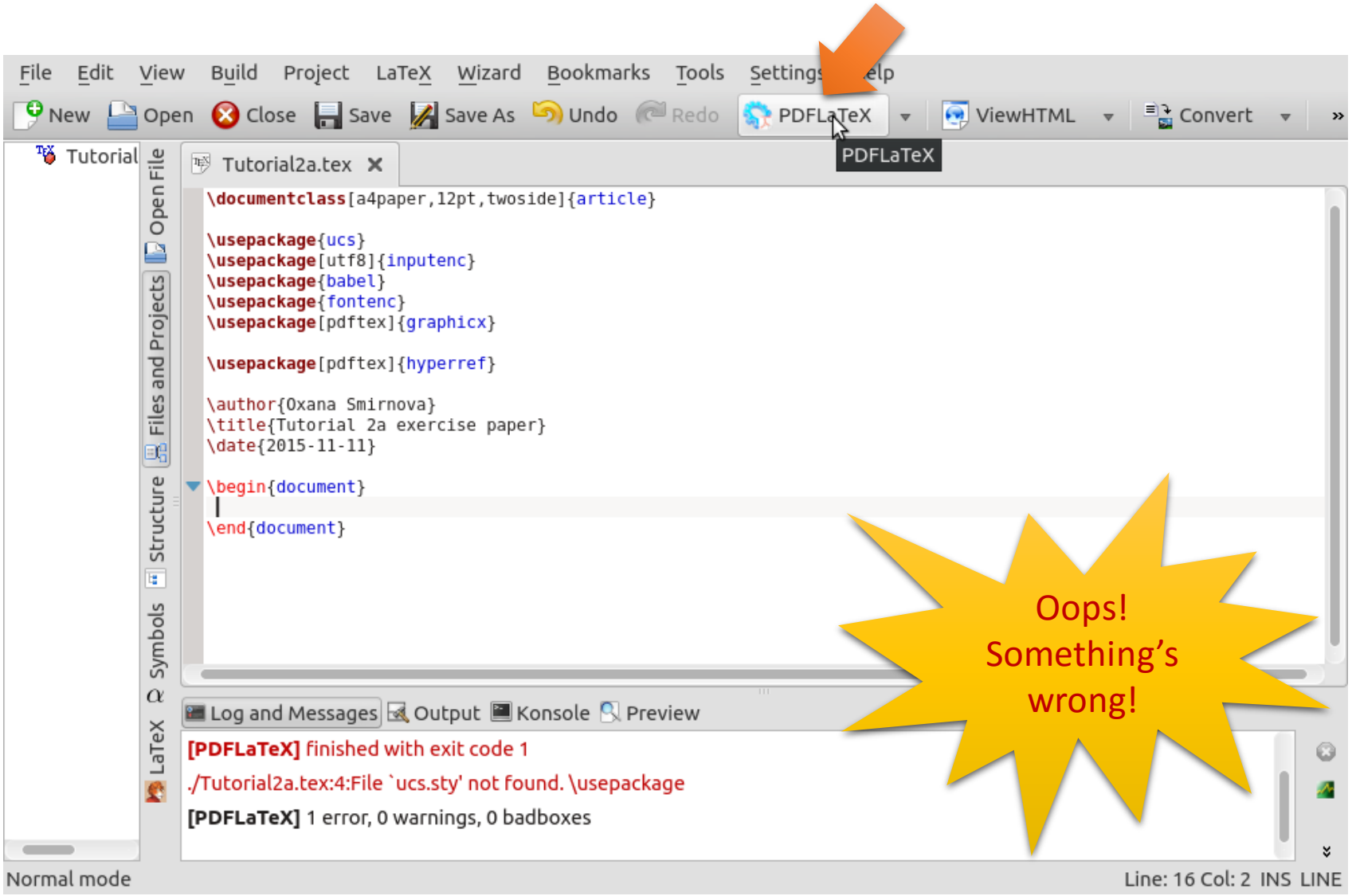


Now it is OK to click OK

Time to save the file

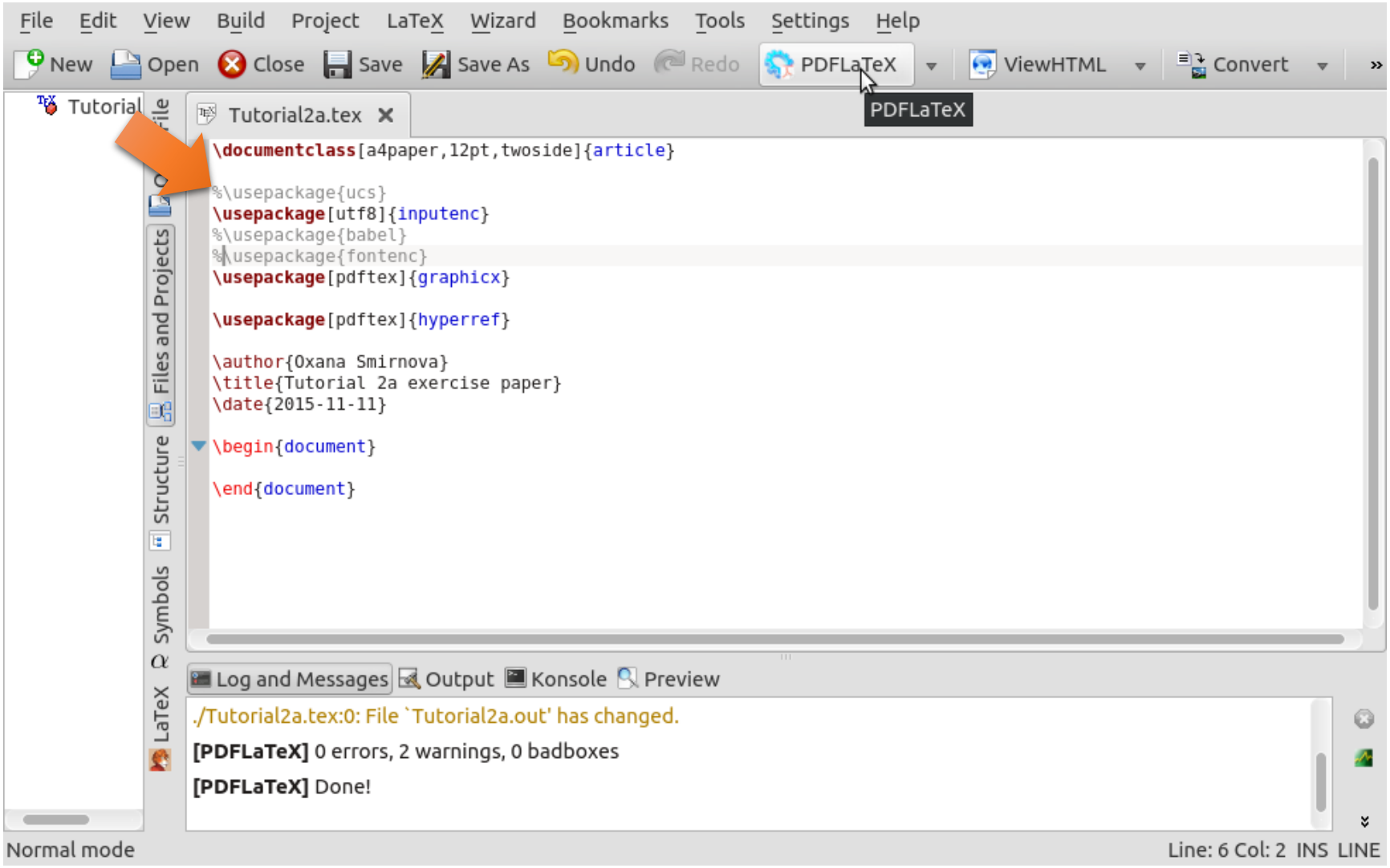


And now let's build it

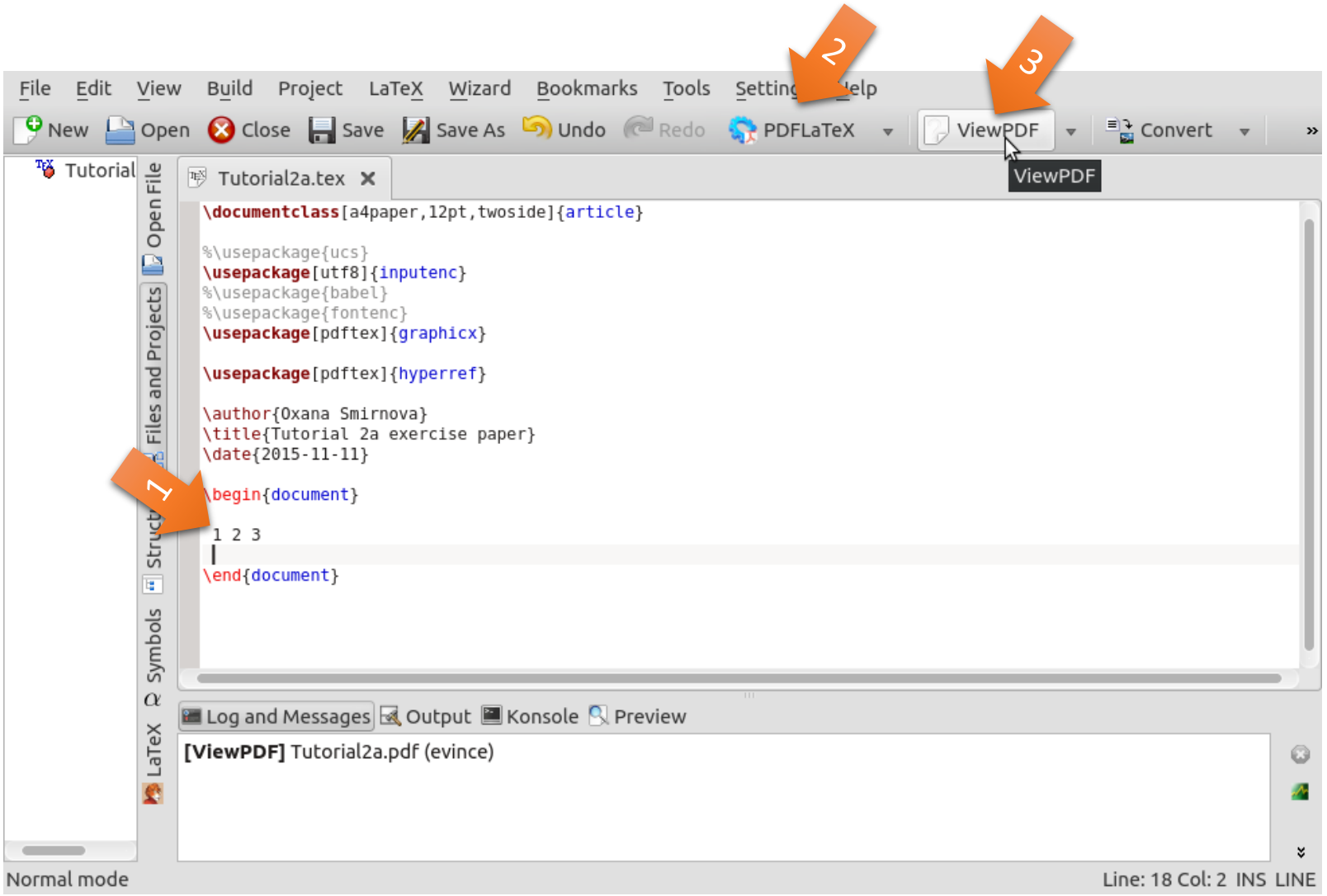


Whatever, we don't need this package, *comment* it out

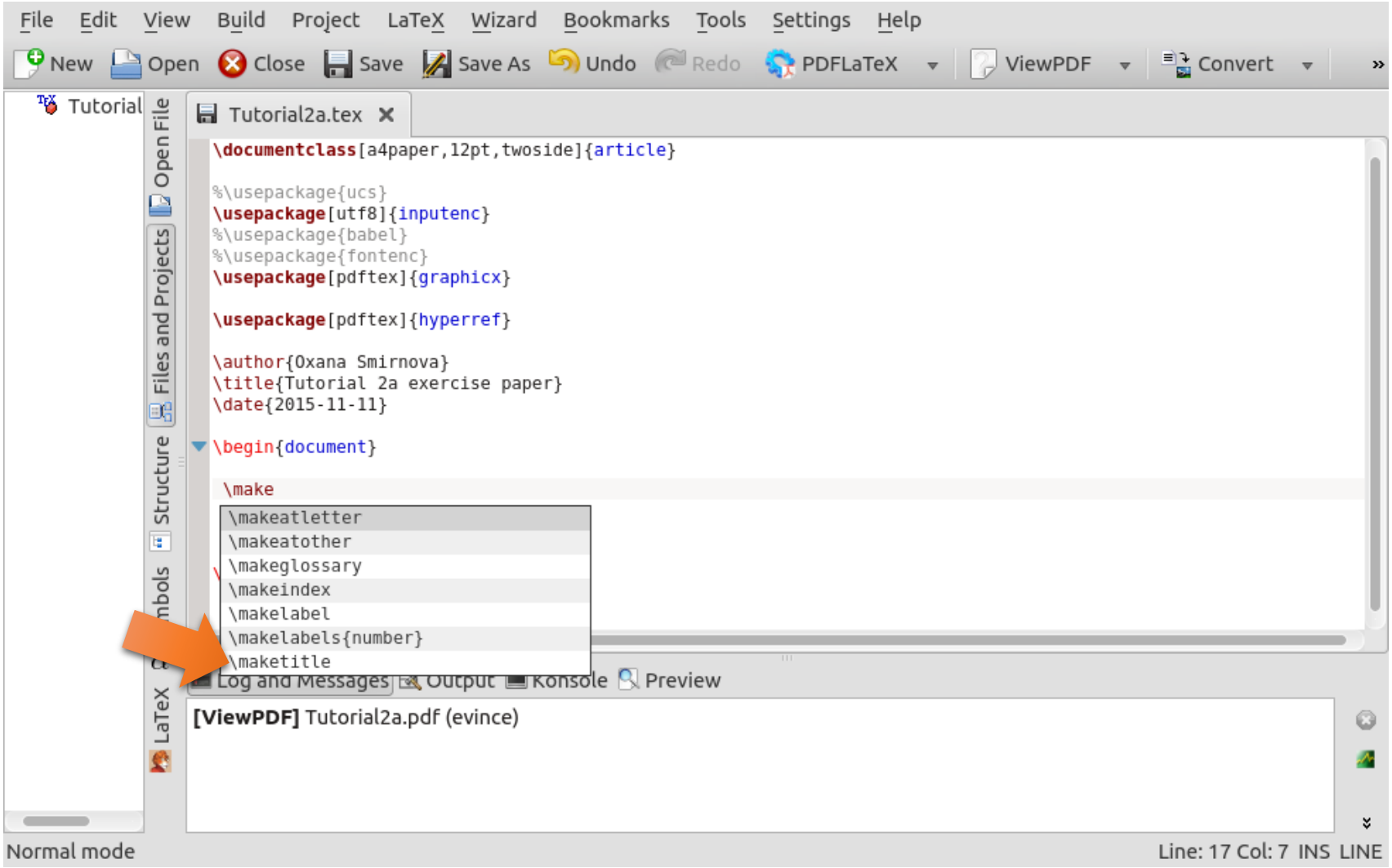
Use % to *comment* (inactivate) any line in LaTeX; you can turn off many packages



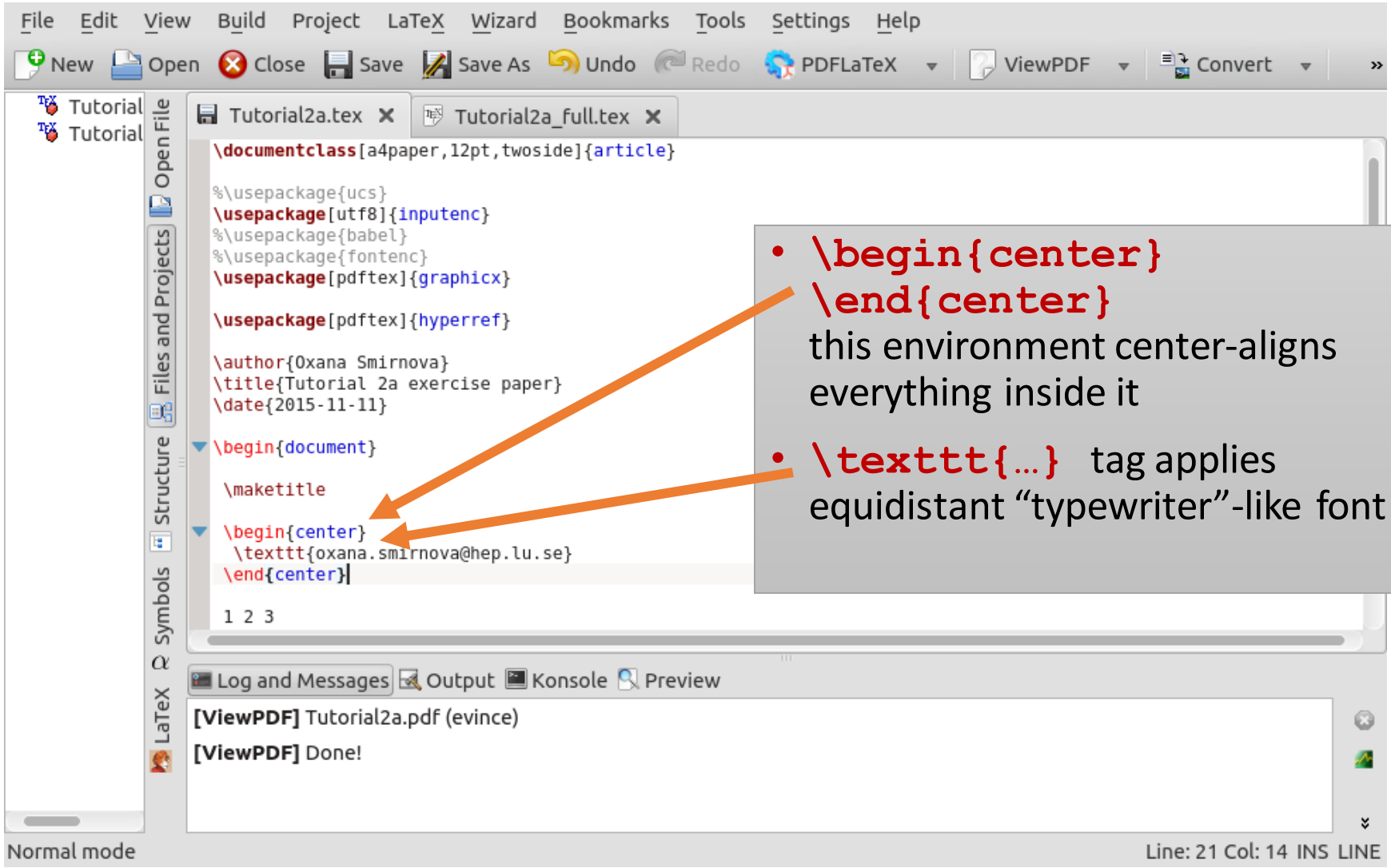
Add some text, build and view the result



Where's the title? Let's make it: `\maketitle`

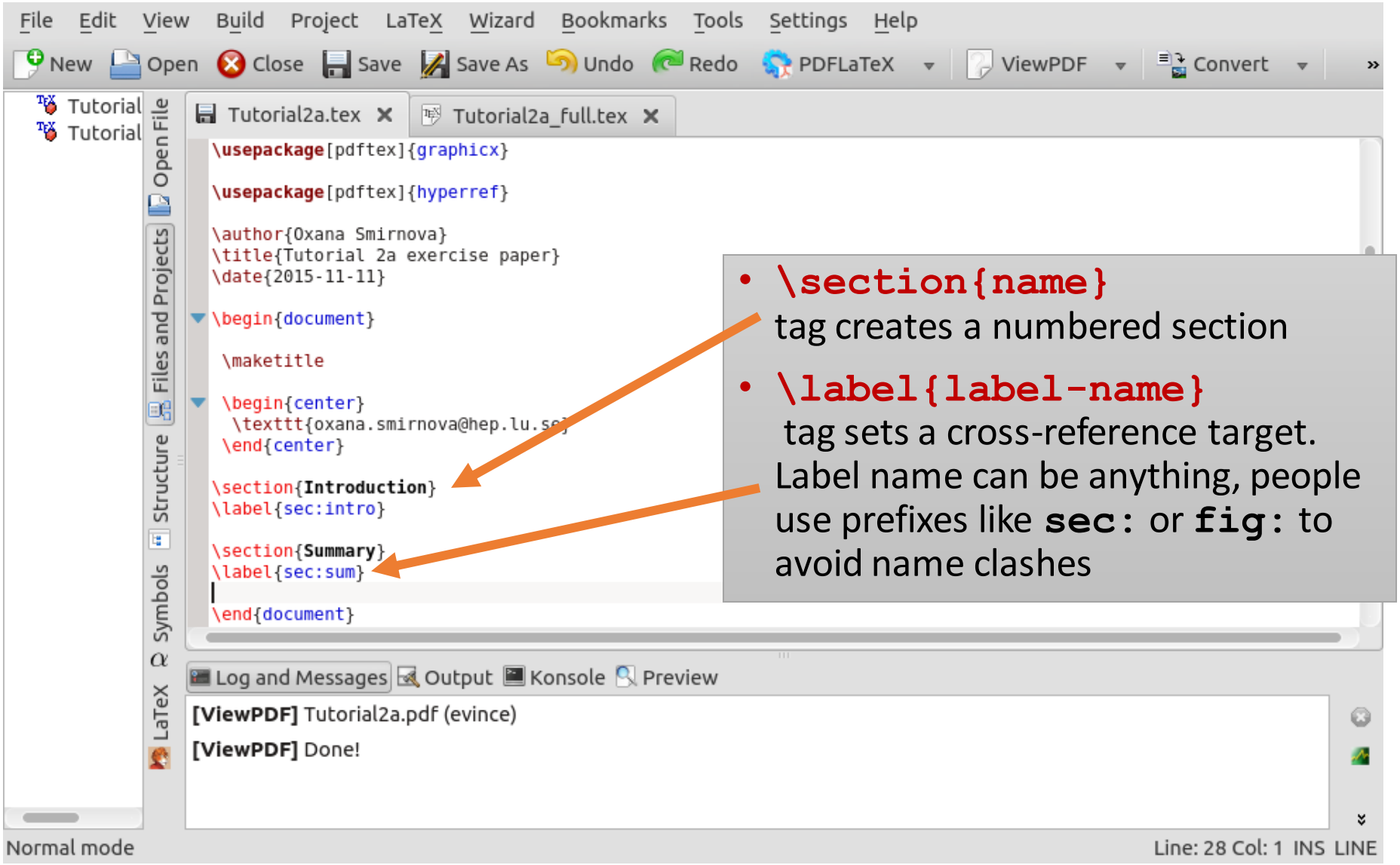


Would be nice to add e-mail, centered



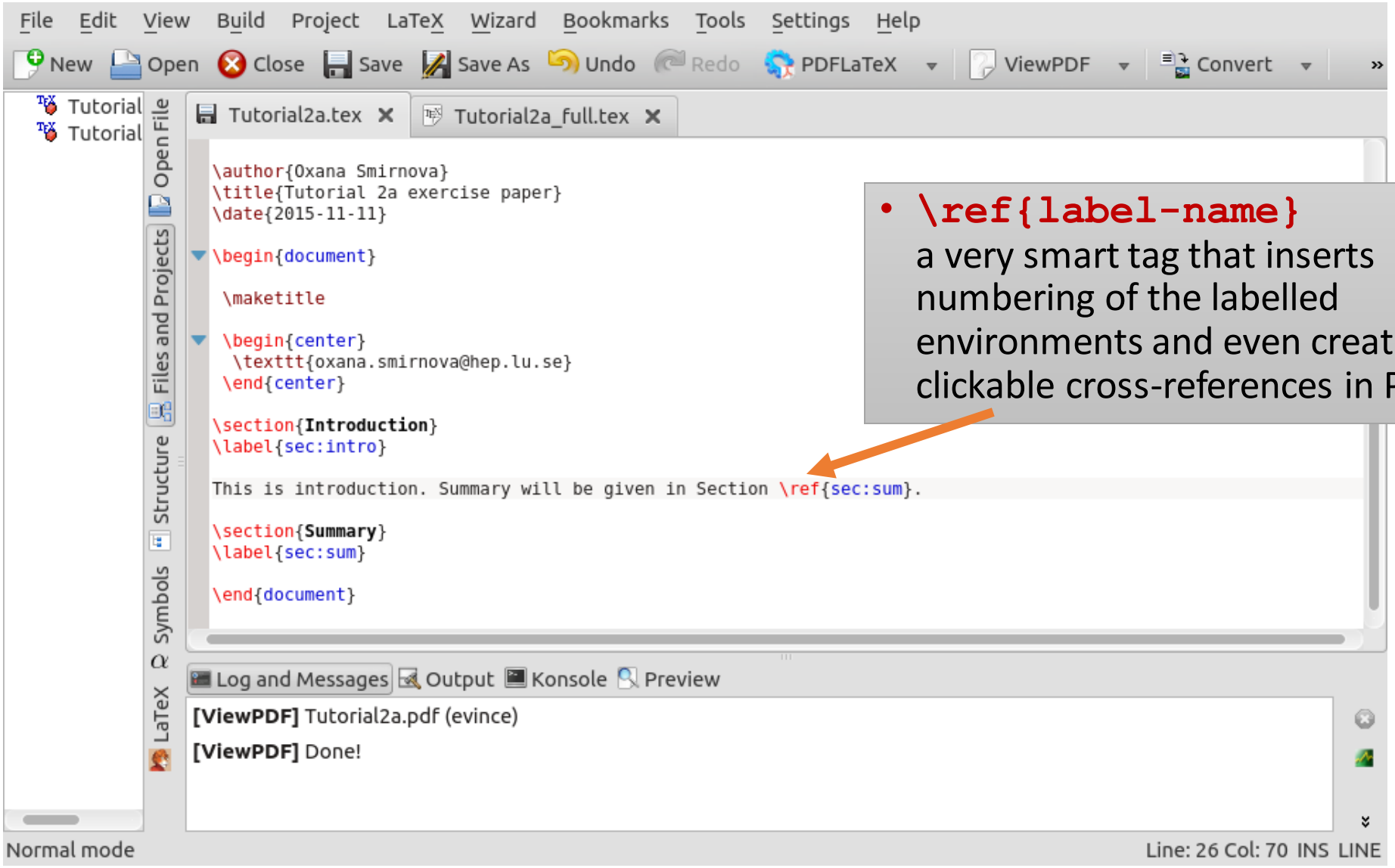
- **`\begin{center}`**
  `\end{center}`
  this environment center-aligns everything inside it
- **`\texttt{…}`** tag applies equidistant “typewriter”-like font

Time to add some sections and labels for cross-reference

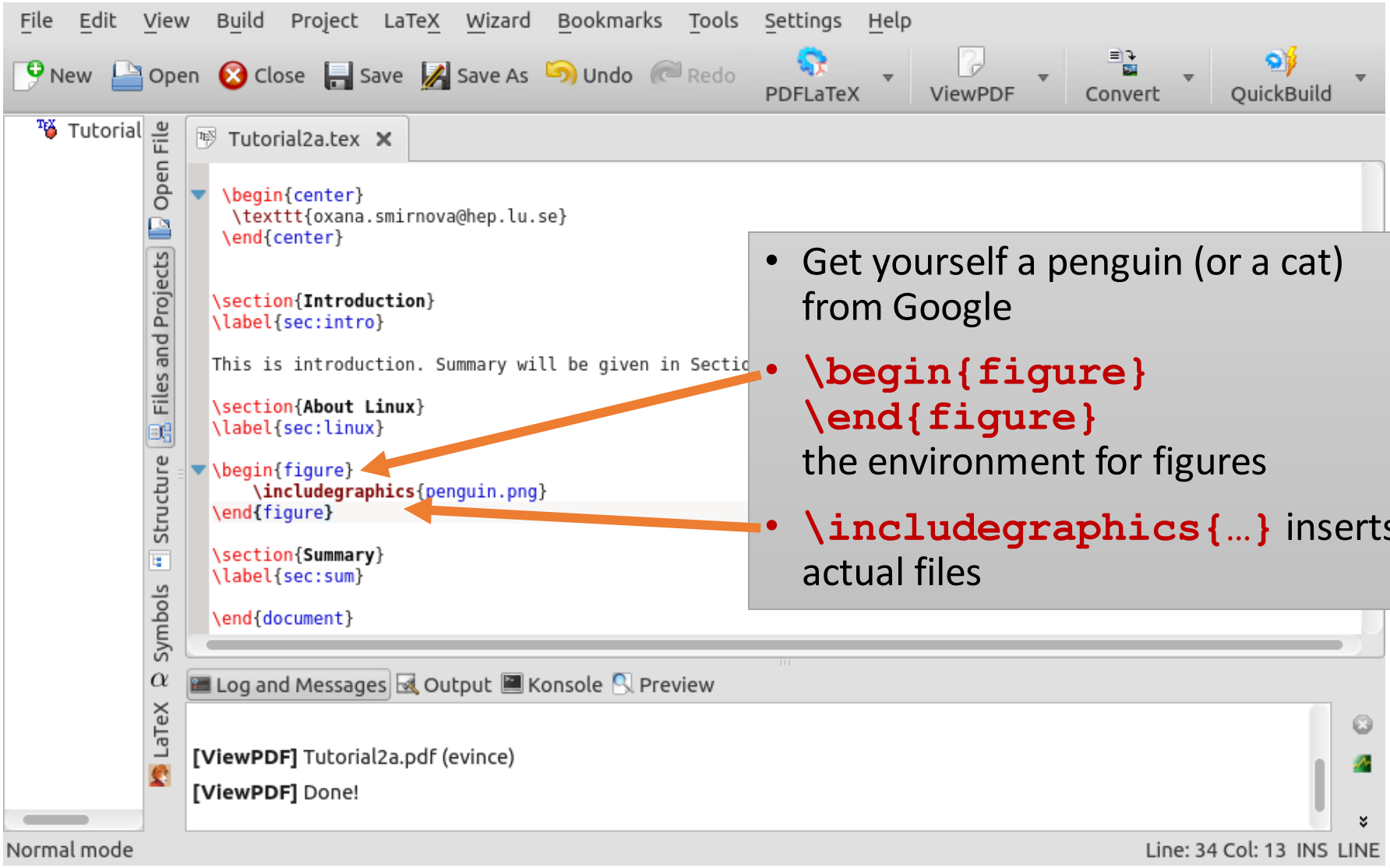


- **`\section{name}`** tag creates a numbered section
- **`\label{label-name}`** tag sets a cross-reference target. Label name can be anything, people use prefixes like **`sec:`** or **`fig:`** to avoid name clashes

So how do we do cross-referencing?

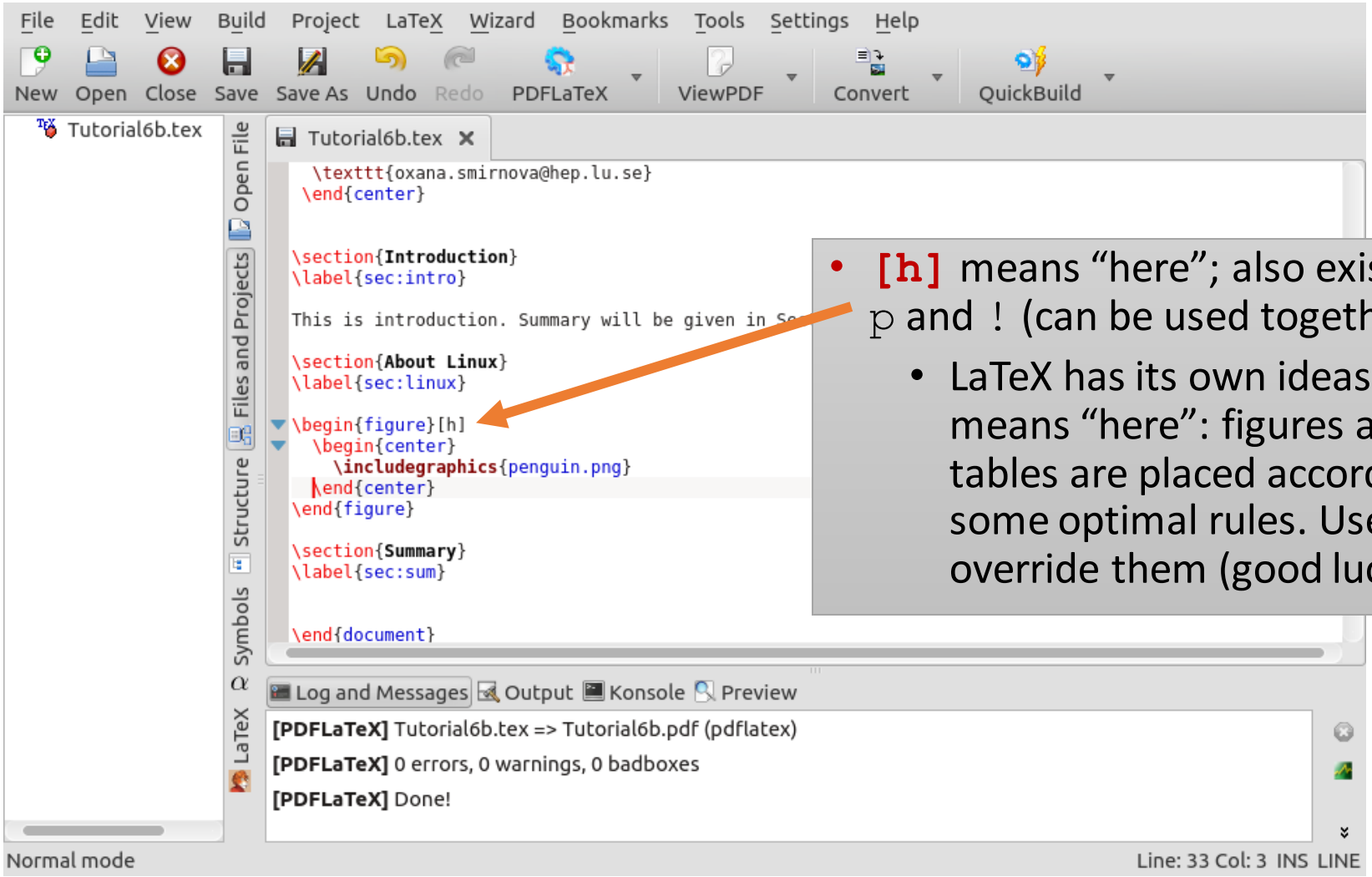


Let's add a picture



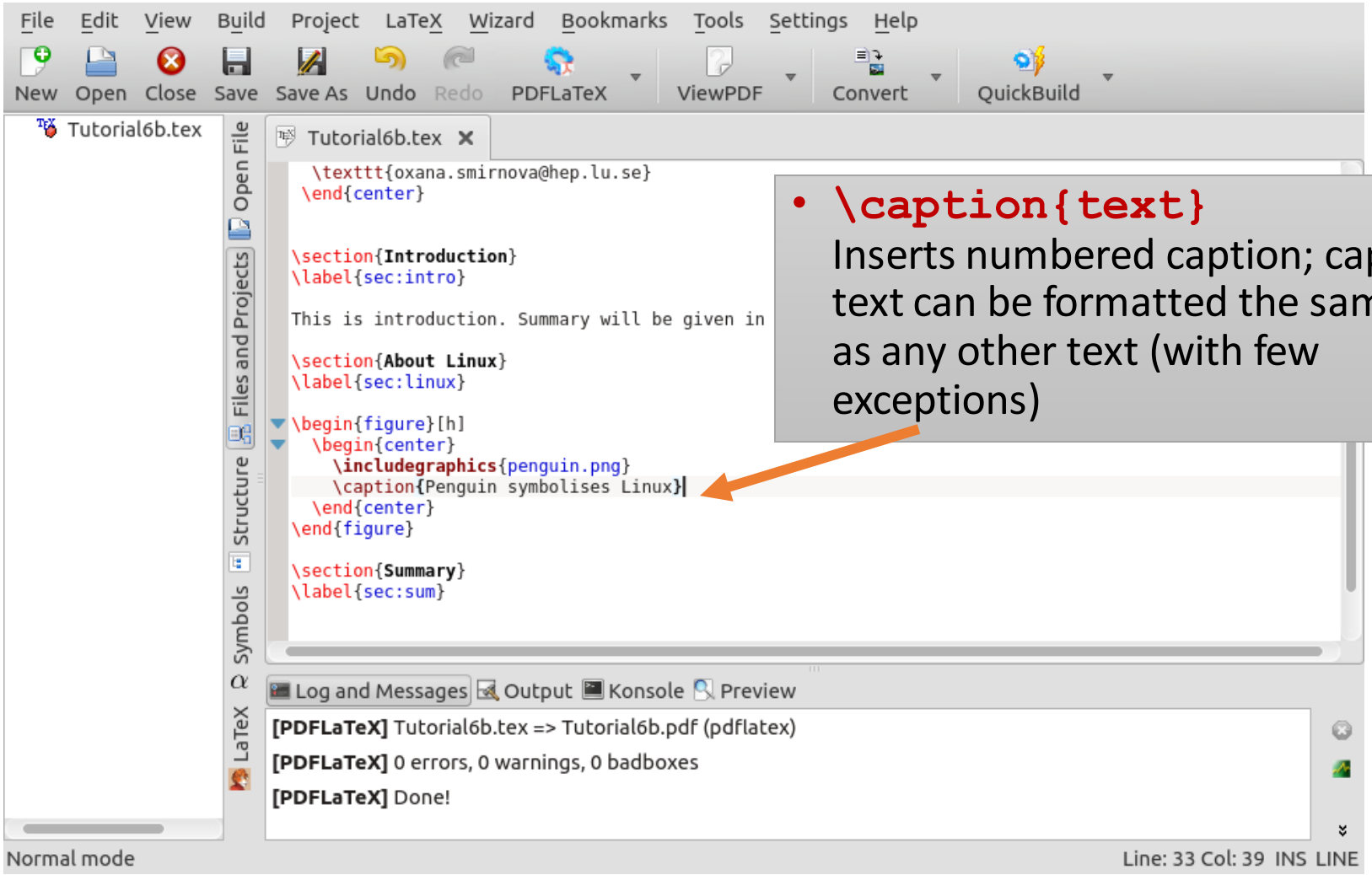
- Get yourself a penguin (or a cat) from Google
- **`\begin{figure}`**
  `\end{figure}`
  the environment for figures
- **`\includegraphics{…}`** inserts actual files

This looked ugly, let's pin it and center it



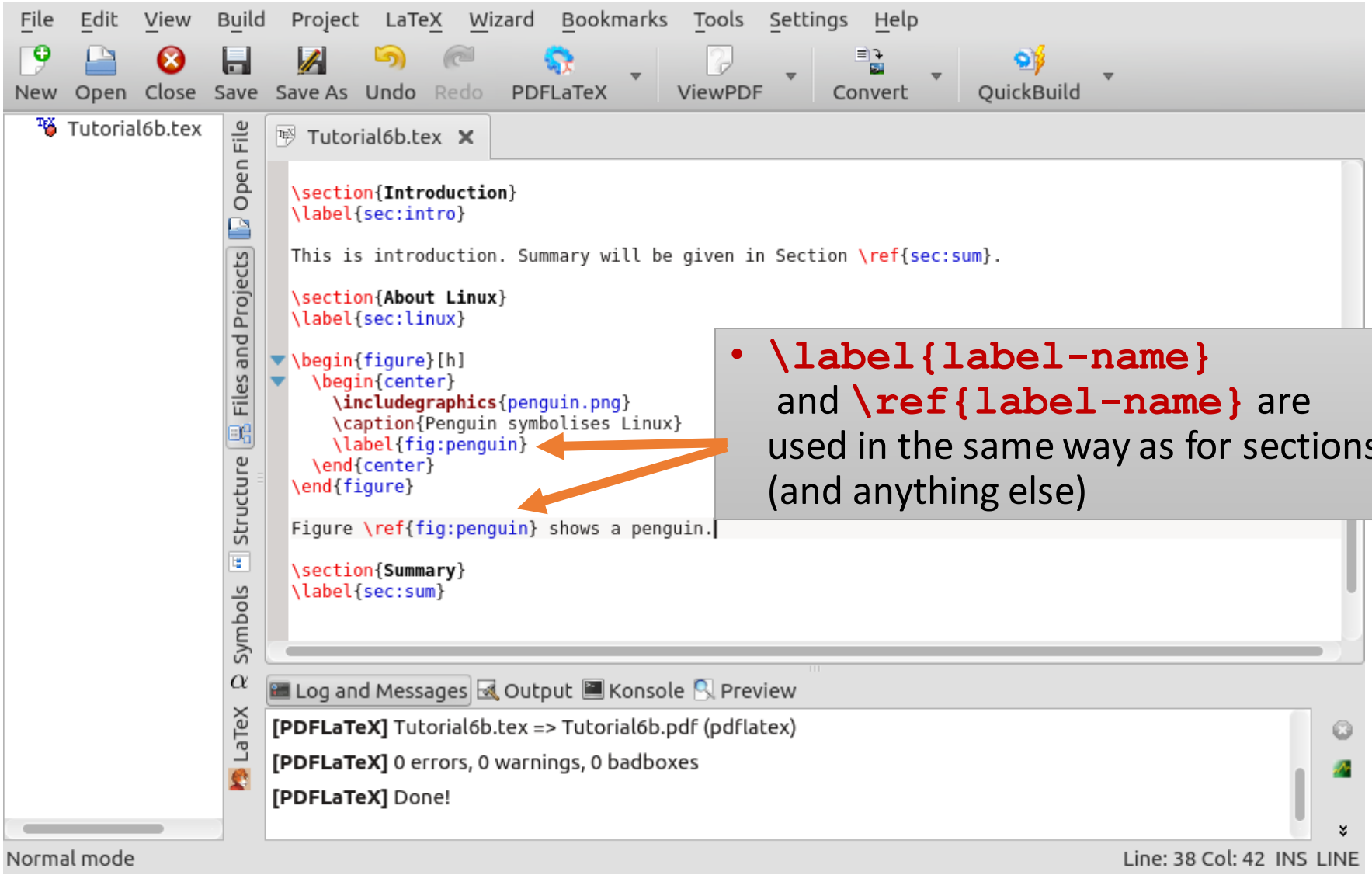
- **[h]** means "here"; also exist `H`, `t`, `b`, `p` and `!` (can be used together)
  - LaTeX has its own ideas what means "here": figures and tables are placed according to some optimal rules. Use "`!`" to override them (good luck…)

Every figure needs a caption



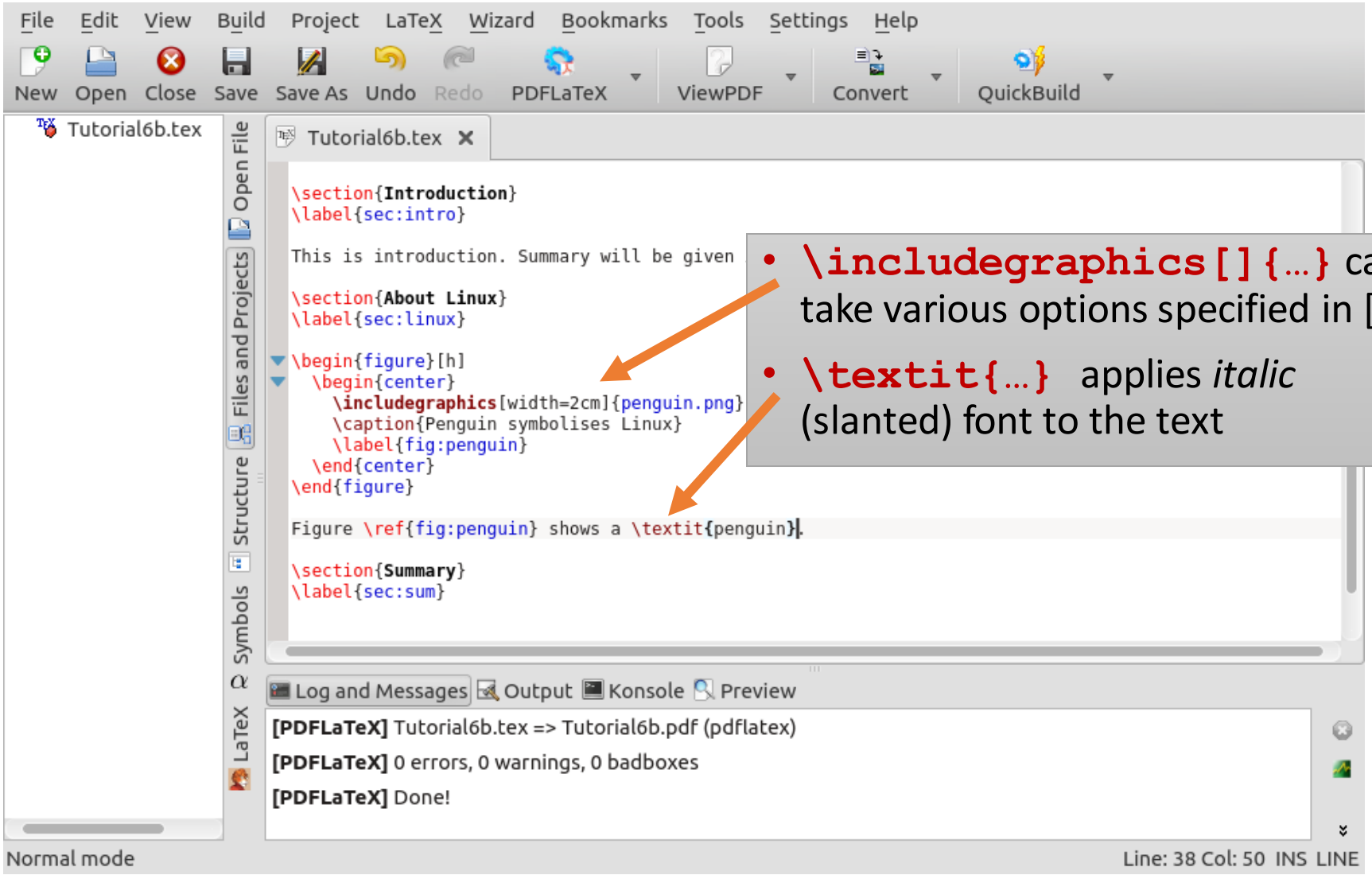
- **`\caption{text}`**
  Inserts numbered caption; caption text can be formatted the same way as any other text (with few exceptions)

We also want to cross-reference figures



- `\label{label-name}` and `\ref{label-name}` are used in the same way as for sections (and anything else)

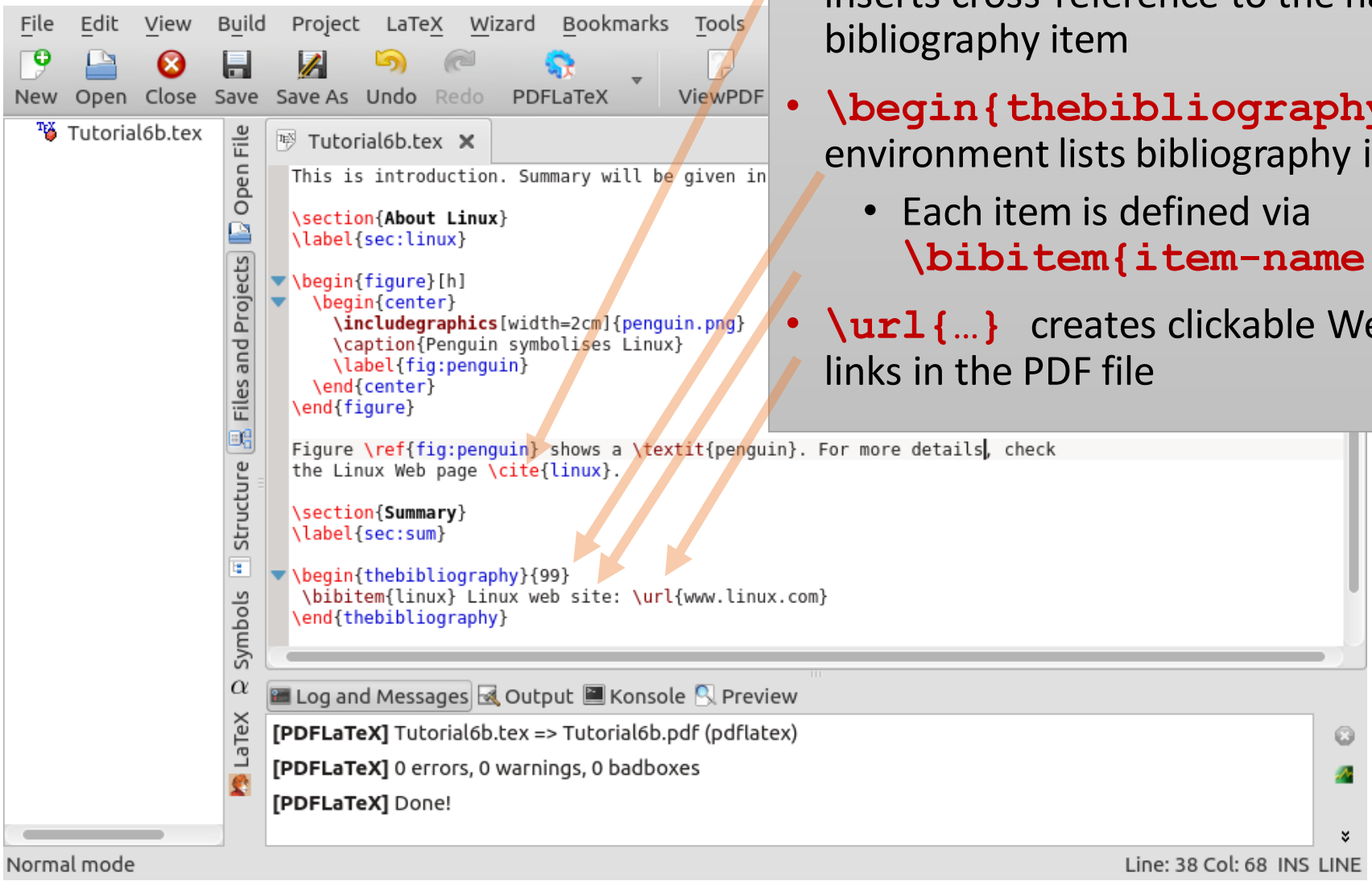
Final adjustments



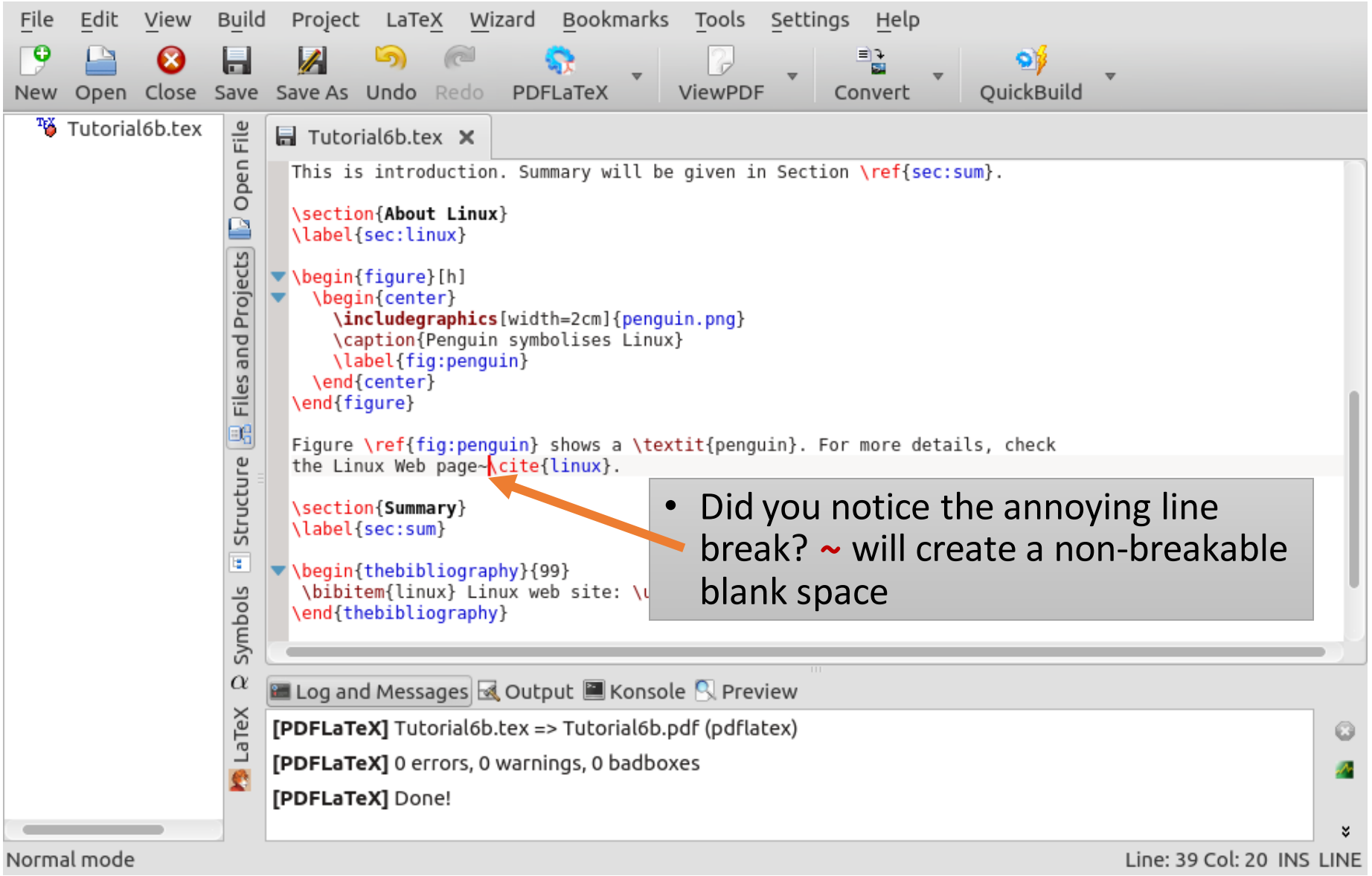
- `\includegraphics[]{…}` can take various options specified in []
- `\textit{…}` applies *italic* (slanted) font to the text

We have to cite bibliography reference now

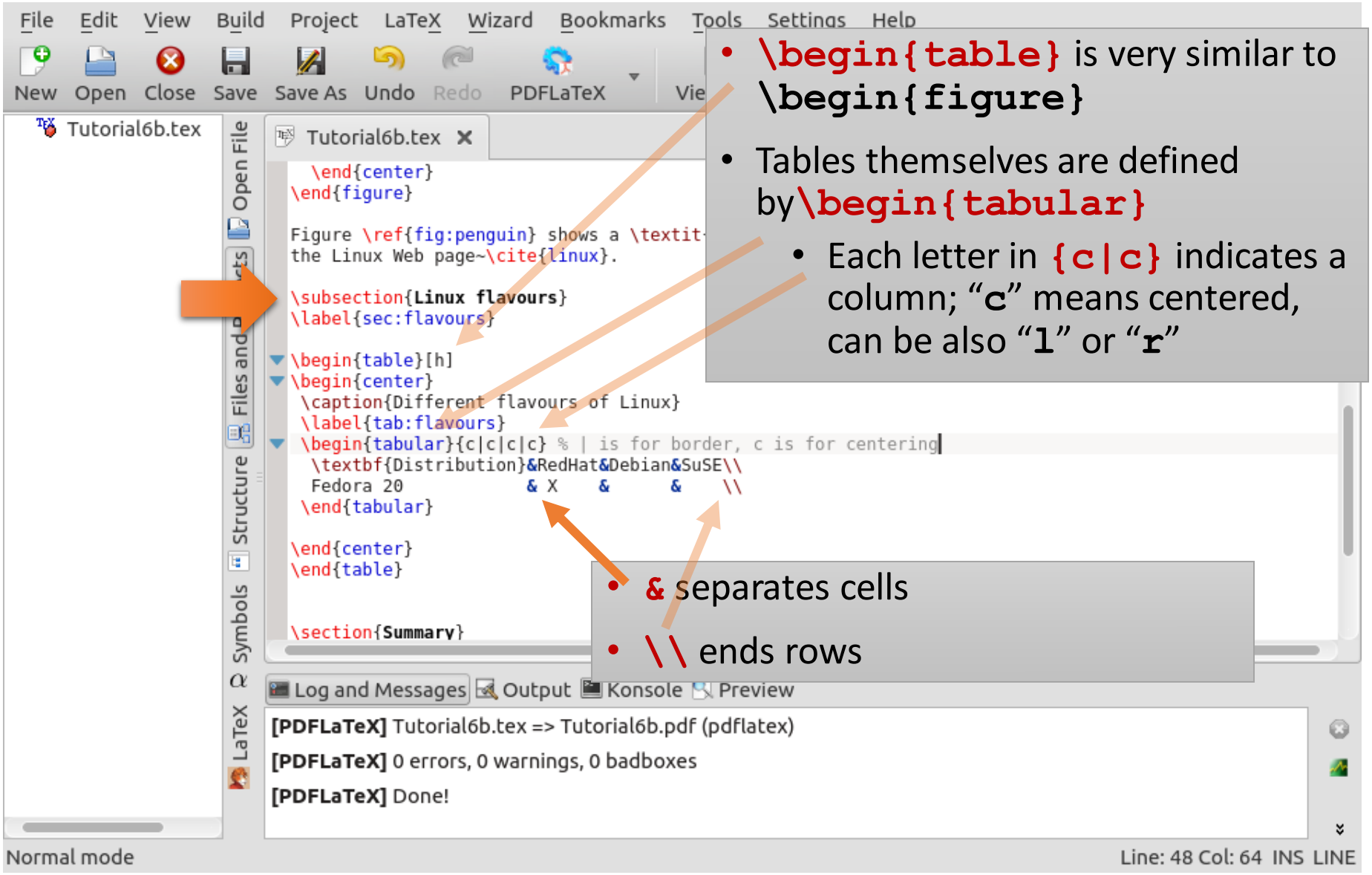
- **`\cite{item-name}`** inserts cross-reference to the named bibliography item
- **`\begin{thebibliography}`** environment lists bibliography items
  - Each item is defined via **`\bibitem{item-name}`**
- **`\url{…}`** creates clickable Web links in the PDF file



One small detail: non-breaking space



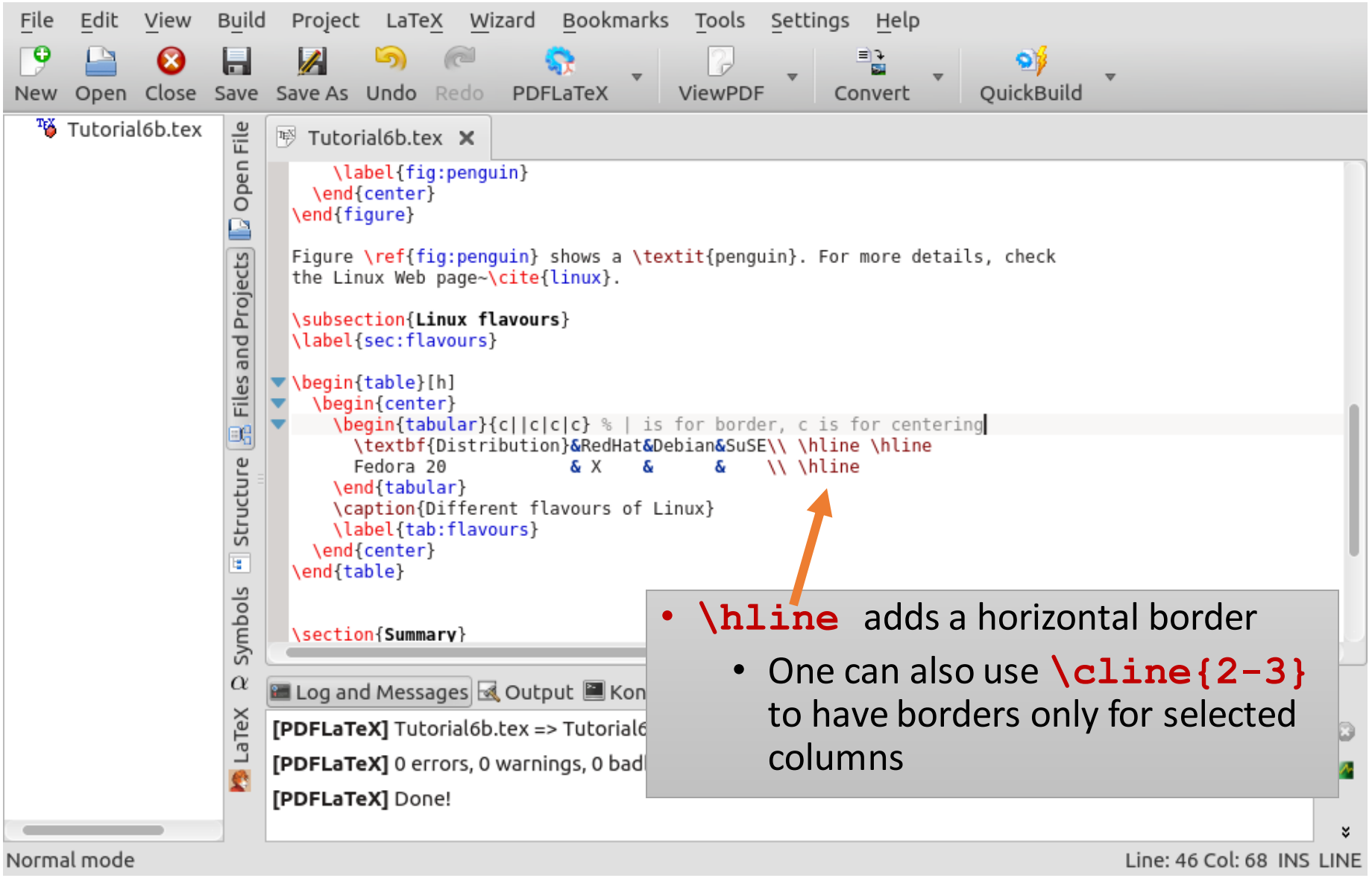
Make a new \subsection and a table



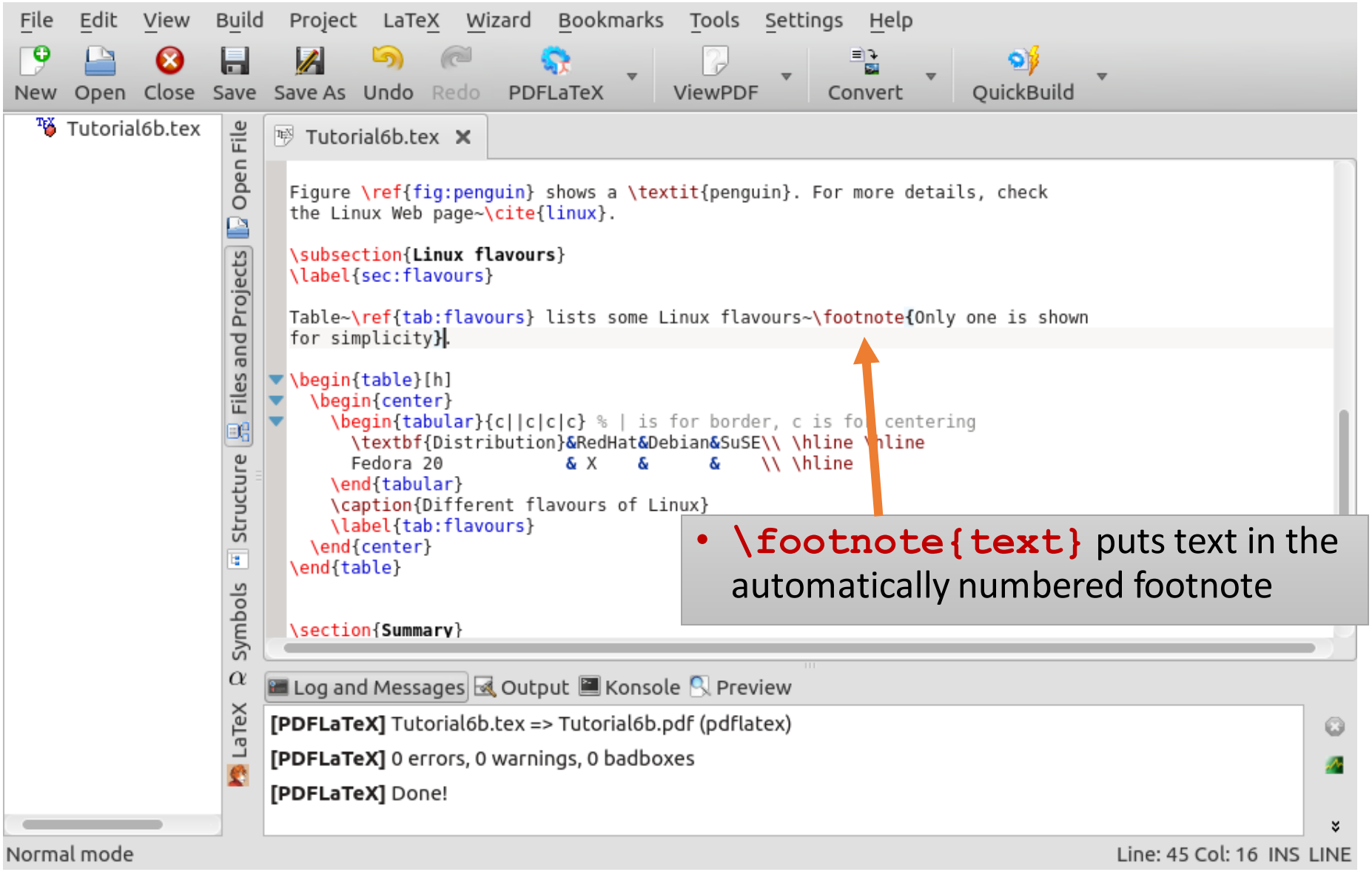
- **\begin{table}** is very similar to **\begin{figure}**
- Tables themselves are defined by **\begin{tabular}**
  - Each letter in **{c|c}** indicates a column; "**c**" means centered, can be also "**l**" or "**r**"

- **&** separates cells
- **** ends rows

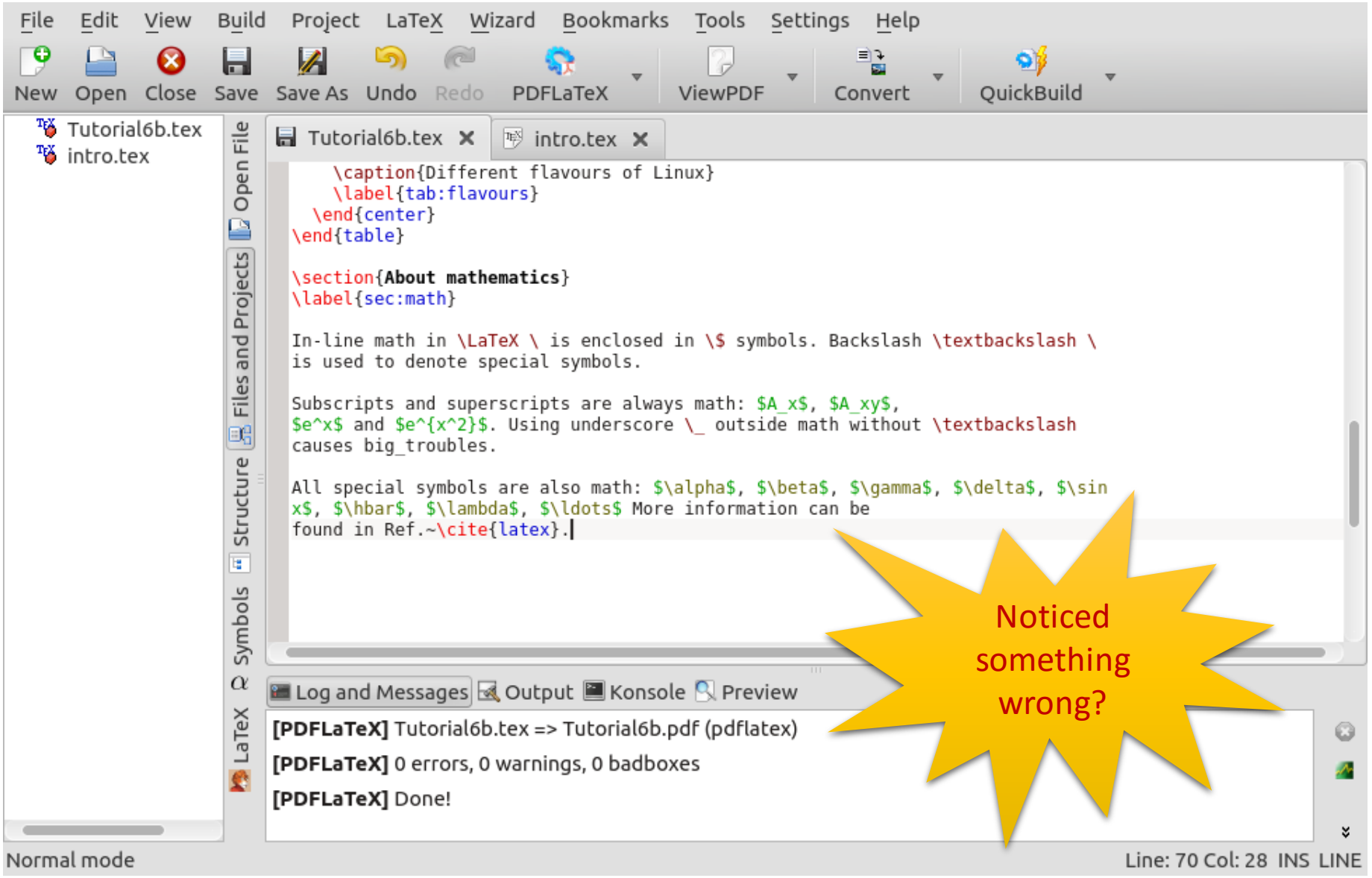
It was an ugly table, let's make it slightly better



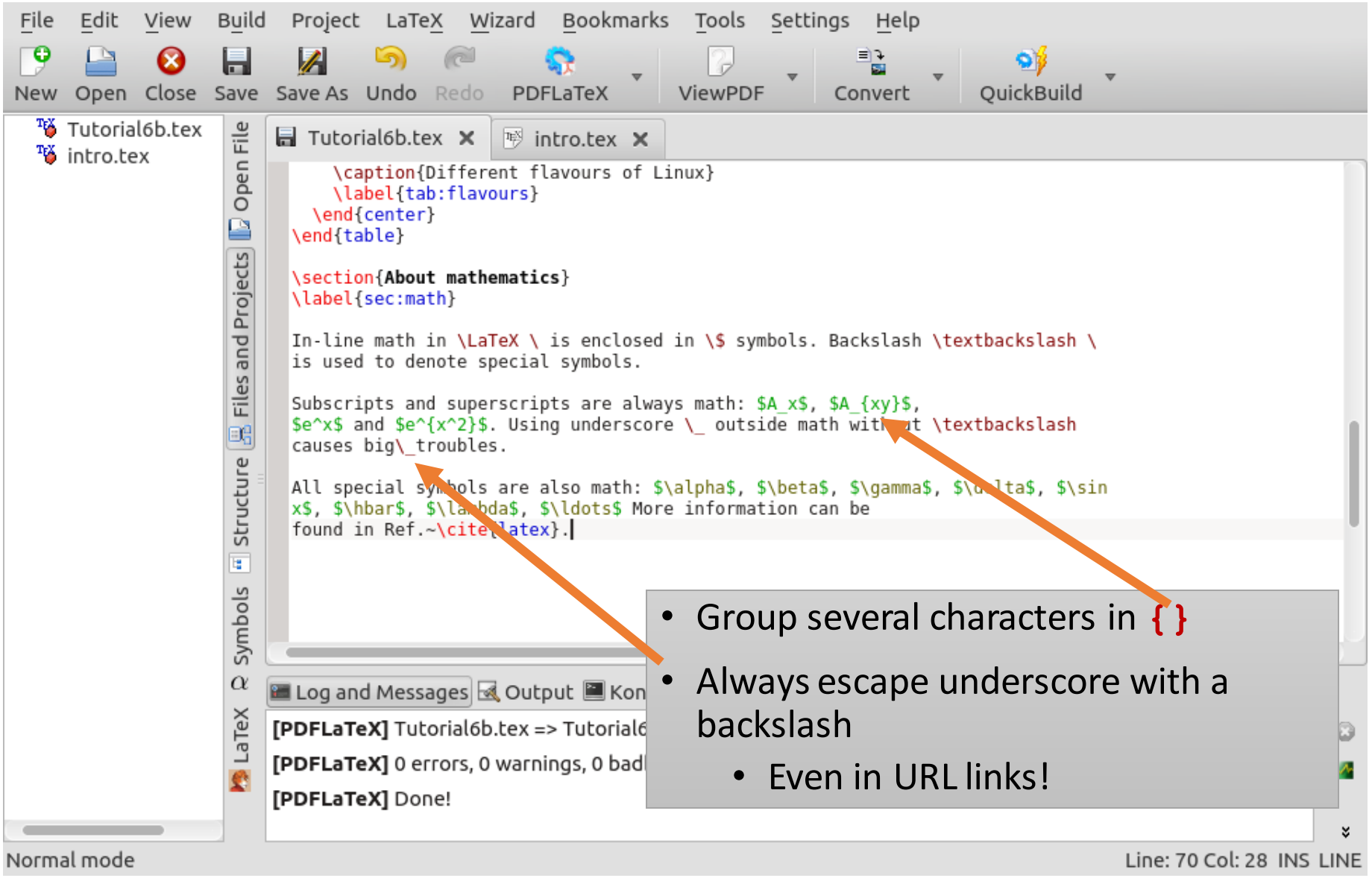
A footnote


File Edit View Build Project LaTeX Wizard Bookmarks Tools Settings Help
New Open Close Save Save As Undo Redo PDFLaTeX ViewPDF Convert QuickBuild
Tutorial6b.tex
Open File
Files and Projects
Structure
Symbols
LaTeX
Tutorial6b.tex
Figure \ref{fig:penguin} shows a \textit{penguin}. For more details, check
the Linux Web page~\cite{linux}.
\subsection{Linux flavours}
\label{sec:flavours}
Table~\ref{tab:flavours} lists some Linux flavours~\footnote{Only one is shown
for simplicity}.
\begin{table}[h]
\begin{center}
\begin{tabular}{c||c|c|c} % | is for border, c is for centering
\textbf{Distribution}&RedHat&Debian&SuSE\\ \hline \hline
Fedora 20 & X & & \\ \hline
\end{tabular}
\caption{Different flavours of Linux}
\label{tab:flavours}
\end{center}
\end{table}
\section{Summary}
• \footnote{text} puts text in the automatically numbered footnote
Log and Messages Output Konsole Preview
[PDFLaTeX] Tutorial6b.tex => Tutorial6b.pdf (pdflatex)
[PDFLaTeX] 0 errors, 0 warnings, 0 badboxes
[PDFLaTeX] Done!
Normal mode
Line: 45 Col: 16 INS LINE

Now let's try mathematics in a new section

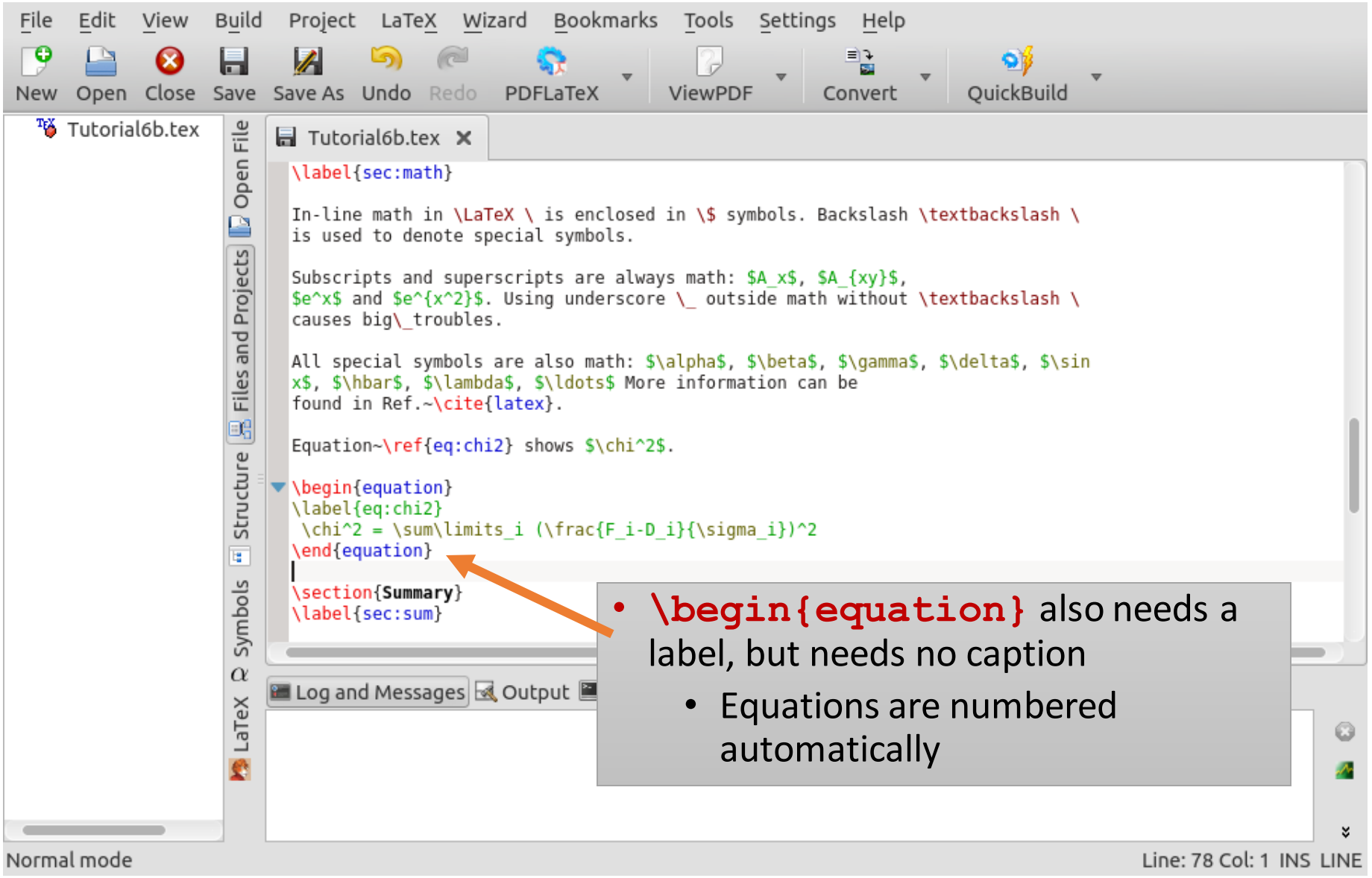


Corrected mathematics text

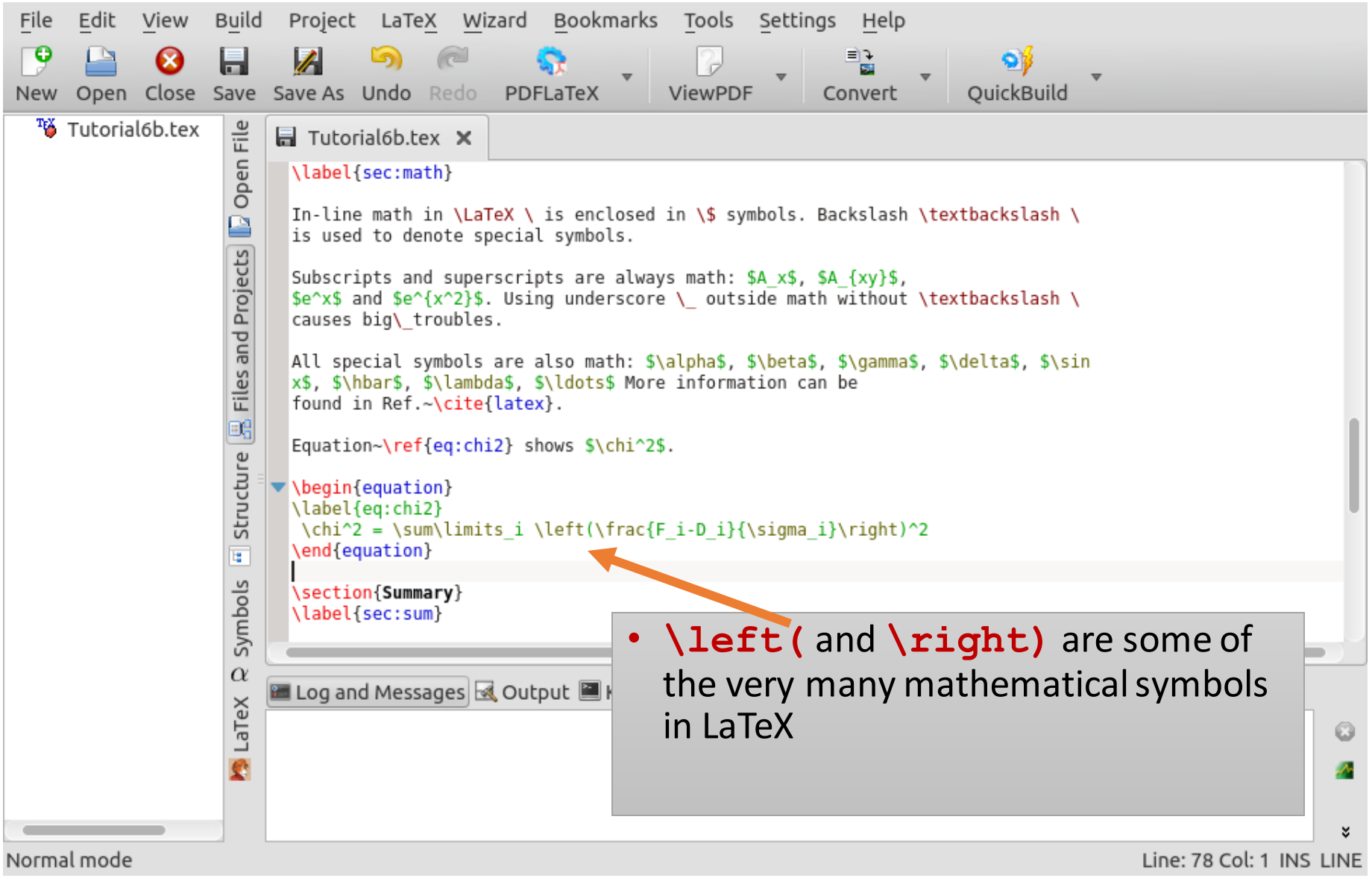


- Group several characters in { }
- Always escape underscore with a backslash
  - Even in URL links!

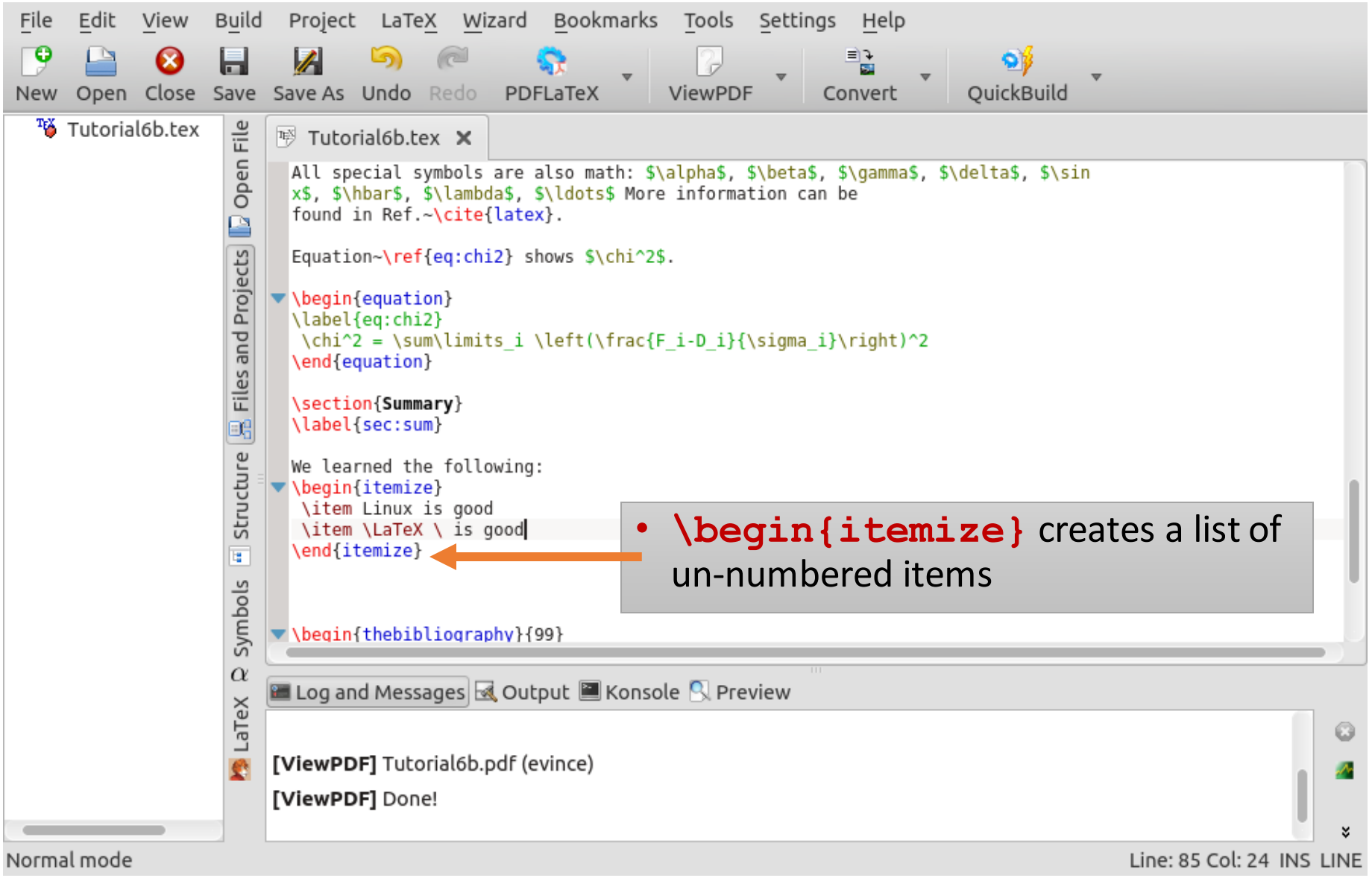
And now let's try an equation



Oh, that was also ugly. Fixing…

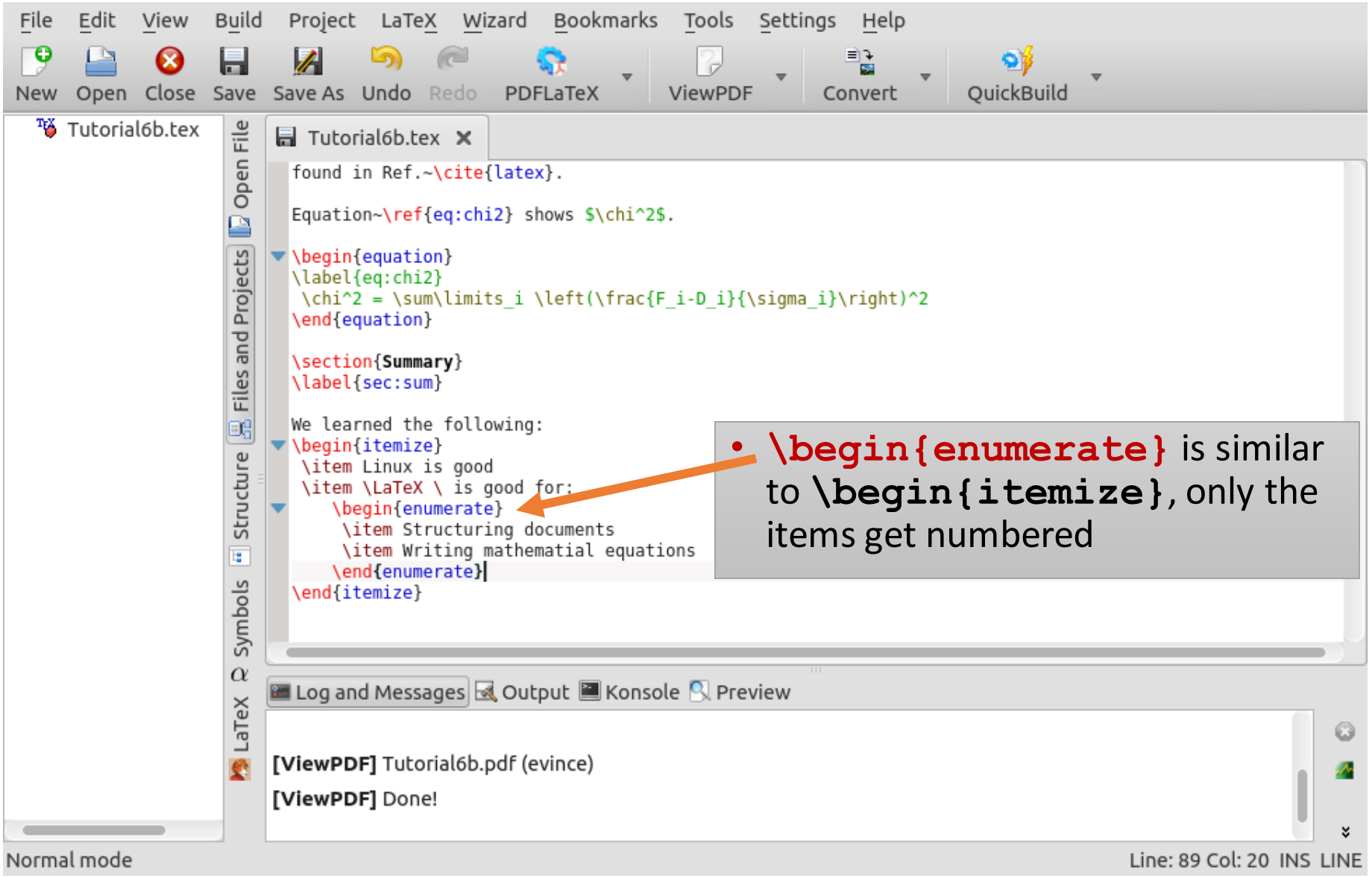


And finally, some bulleted lists

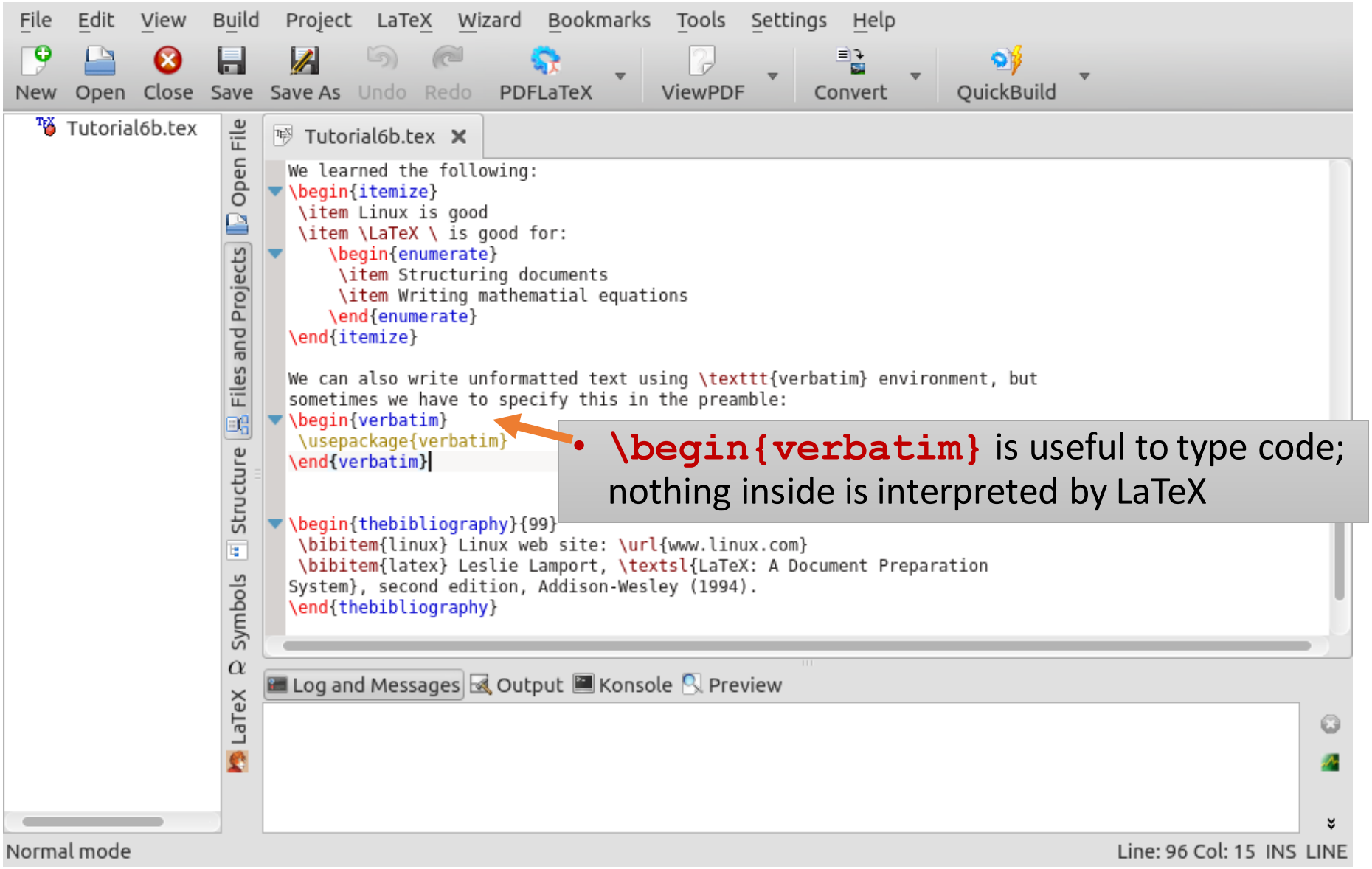


- **`\begin{itemize}`** creates a list of un-numbered items

There are also numbered lists



Last, but not least: you can have unformatted text, too



And the result should look like this:

Tutorial 2a exercise paper

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2015-11-11

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1 Introduction

This is introduction. Summary will be given in Section 4.

2 About Linux

Figure 1: Penguin symbolises Linux

Figure 1 shows a *penguin*. For more details, check the Linux Web page [1].

2.1 Linux flavours

Table 1 lists some Linux flavours [1]

Distribution	RedHat	Debian	SuSE
Fedora 23	X		

Table 1: Different flavours of Linux

[1] Only one is shown for simplicity

3 About mathematics

In-line math in LaTeX is enclosed in $ symbols. Backslash \ is used to denote special symbols.

Subscripts and superscripts are always math: A_x, A_{xy}, e^x and e^{x^2}. Using underscore _ outside math without \ causes big_troubles.

All special symbols are also math: α, β, γ, δ, $\sin x$, $\hbar$, λ, ... More information can be found in Ref. [2].

Equation 1 shows χ^2.

$$\chi^2 = \sum_i \left(\frac{F_i - D_i}{\sigma_i} \right)^2 \quad (1)$$

4 Summary

We learned the following:

- Linux is good
- LaTeX is good for:
  1. Structuring documents
  2. Writing mathematial equations

We can also write unformatted text using `verbatim` environment, but sometimes we have to specify this in the preamble:

```
\usepackage{verbatim}
```

References

[1] Linux web site: www.linux.com

[2] Leslie Lamport, *LaTeX: A Document Preparation System*, second edition, Addison-Wesley (1994).

Concluding notes

- There are many more LaTeX tags and environments
- Those tags and environments we tried have many different options
- Every tag and environment can be modified and tailored to your needs
- There is no way you can remember all the tags; get yourself a book (many good books exist), or use any of the multiple online references
  - Wikibooks: http://en.wikibooks.org/wiki/LaTeX
  - LaTeX Reference Manual: http://home.gna.org/latexrefman/
- All serious scientific journals have official LaTeX templates and styles, usually complete with instructions